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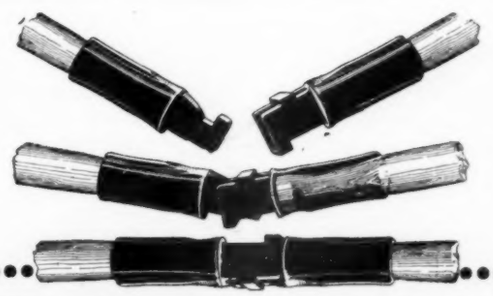

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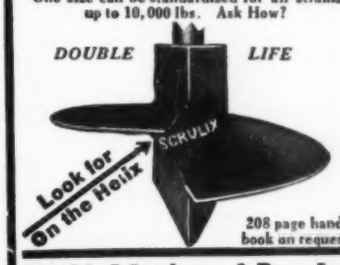

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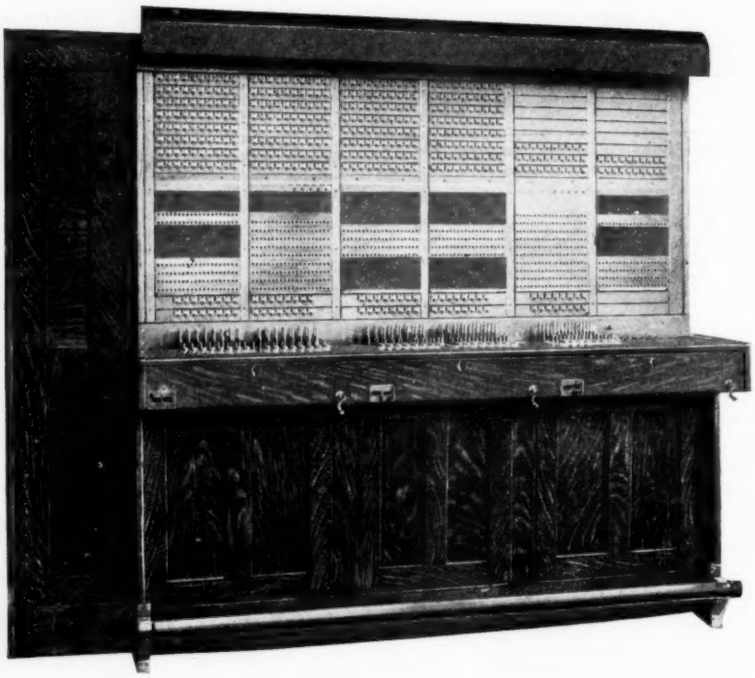

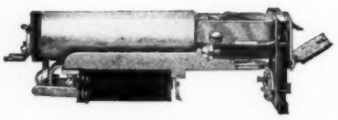

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CURRENT OPINIONS AND COMMENTS

Never before in the history of this country has it been so necessary for a man to know thoroughly the ins and outs of his business. It has always been profitable to be well posted about the details of one's business, but the general conditions which prevail today make it vitally essential.

An experienced and successful telephone man told TELEPHONY the other day: "My experience and observation point to the fact that although the average telephone manager is a fairly good plant man, and is more or less familiar with circuits and equipment, he does not know very much about the traffic end of his job.

Many managers of small and medium-sized Independent plants would be unable to operate their property if it were not for the fact that they have competent chief operators who know more about the distribution end of the business than the managers do themselves. Many chief operators who are ambitious and untiring in their efforts to give their subscribers good service are handicapped by the fact that their managers know little or nothing about traffic, and, therefore, cannot appreciate their problems."

* * * *

As this statement came from a man qualified to speak with authority he was asked how he accounted for such a condition.

"I believe the present situation," he said, "is the outgrowth of a general impression among telephone men that operating is a girl's work and is not worthy of much of their attention. A great many telephone men, I find, dislike anything connected with traffic work, and it is only natural for any of us to dislike things we know little about.

"I believe the time has come, however, when all telephone men should realize that the rendering of service is more important than any other one thing connected with the telephone business, and no manager can intelligently direct his forces in the furnishing of service without an understanding of at least the fundamental elementary principles of traffic work."

* * * *

No doubt the average manager has his time fully occupied looking after rate questions, maintenance, construction and various other matters that keep him hustling from Monday to Saturday—often including Sunday—and is glad to have a competent chief operator to shoulder the burden of handling traffic problems. There is, however, food for thought in the foregoing quotation.

Knowledge of traffic enables the manager to know when his staff is doing good work and getting the best results. Familiarity with the subject would also enable him to advise and help his operating force. His chief operator would also work to better advantage, knowing that the boss understood things and appreciated her difficulties and problems.

Therefore, Mr. Manager, it will pay you to devote more of your attention to traffic matters, for good service is what you are selling to your customers.

The action of the Kansas Public Utilities Commission in appointing a practical telephone man to handle telephone rate cases furnishes a good example which other state regulatory bodies might follow with profit to all concerned.

J. H. Ainsworth, who goes to Topeka to assist the Kansas rate-makers, has had a broad telephone experience with large Independent and Bell companies, and should be able to smooth out some of the wrinkles caused in that state by the political changes from commission to industrial court and then from court back to the commission system.

Politics has too much influence with utility regulation by commission in most of the states. As long as commissioners are numbered among the political appointments, there probably will not be much improvement in this direction, for the average governor will name the men who will bring him political strength, instead of men whose talents and experience qualify them to pass on utility questions.

If politics is to govern the administration of utility law then, it is, therefore, a material advantage for the commission to have available the advice of a practical man who knows the business. He can save the commissioners from making big blunders and exposing their ignorance of the issues involved, and, what is more important, see that the public and the service corporations are both fairly treated.

* * * *

Judge S. A. Lindsey, president of the Gulf States Telephone Co., who is also

head of the National Bank of Commerce, Houston, Tex., makes an analysis of the business situation which contains so much hard, common sense, that it should be heeded by every business man and worker in the country.

According to his belief, the people of the United States should not wait for Europe to recover, but should buckle down to work and solve their own problems by industry and thrift. He points out that prices of farm products and raw materials are higher than in 1914, business is no worse and unemployment is no more general than the average for the 10-year period before the war.

The trouble, as he sees it, is that too many people are still demoralized from the war boom. They want the government to carry them along instead of going to work and pushing ahead as they did back in 1914.

"I maintain," says Judge Lindsey, "that any person who is willing to produce or handle goods of merit can, by hustling, sell them at a fair price; that any person who is willing to render an old-fashioned day's work of interested efficiency can find and hold employment at a fair wage; that any farmer who grapples with his own problems on his own farm can make as good a living and as good progress at the present prices of farm products as he did before the war; that brick and lumber can be profitably manufactured at present prices, and that every one of character and industry and ability who will try to do things on the old-fashioned work and hustle plan, can get as much credit as he ever could in any normal time."

* * * *

Judge Lindsey is not convinced that fall will bring the improvement that many expect, unless the people go back to work, but he believes the country has nothing to fear if an honest effort is made to use its opportunities. He believes we should sell manufactured articles made here instead of selling our raw materials abroad.

"The world will sooner or later take all we have to sell," he says, in conclusion. "Equitable adjustment in prices of labor, materials and goods is inevitably taking place. When this has progressed and we take our eyes off Washington and Europe and set to work as we should do we shall surely enjoy a long period of satisfying prosperity.

"I say 'satisfying prosperity,' because the prosperity of the future is sure to be that resulting from earning by honest toil, industry and trade, which bring strength and repose to the people, and not from rising prices, inflated currencies and speculation which bring restlessness, discontent and a wrong attitude of people toward earning their bread by the sweat of their brow."

Electrical Capacity—Condensers

An Article for the Practical Man Which Presents the Fundamental Principles of Electrical Capacity in a Simple and Understandable Manner—The Action of Condensers—Effects of Capacity Upon Telephone Circuits

By A. E. Burns

Perhaps the fundamental difficulty in our conception of "capacity" is the fact that we have to do mostly with the laws governing electricity at rest or in a "static" condition, while our everyday training and experience has been largely with electricity in motion, or "current electricity."

Like all other similar subjects, there is really no sharp dividing line between these two conditions, the difference being in the degree in which certain effects are

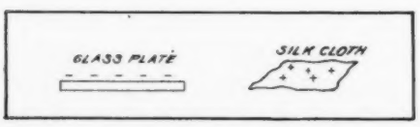


Fig. 1. Conditions of Electrical Charges.

in evidence. For instance, in current electricity we probably make most use of the magnetic effect, yet we have voltage or potential effects as well.

In static electricity, on the other hand, we ordinarily notice the voltage effects to the exclusion of all others; yet to produce a static charge, we must move electricity from somewhere. This movement of electricity is nothing more nor less than a current and so produces magnetic effects which, however, are usually too

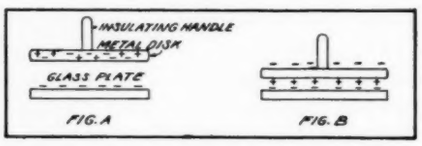


Fig. 2. Changes of Electrical Charges.

small to notice on account of the *small amount* of electricity moved.

Experiment—The Electrophorus.

The following experiment is not spectacular in any way, but it merits close attention as it covers, in large part, the fundamental principles of capacity.

(1). A hard rubber or glass plate or other dielectric is briskly rubbed with a piece of silk. It will then be found to be electrified, the electric charges or electrons being actually rubbed off, according to one theory of the matter.

Metals may be electrified in the same way but, being conductors, the charges leak away as fast as they are produced unless special precautions are taken.

(2). The electrical condition will be

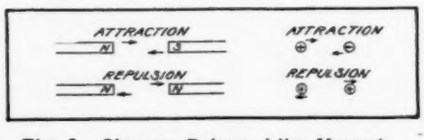


Fig. 3. Charges Behave Like Magnets.

as shown in Fig. 1 It will be noted that the amount of negative (—) electricity produced on one body is equal to the amount of positive (+) electricity on the other.

(3). We now take a metal disk with an insulating handle which has been lying on the table and bring it towards the glass plate. Since the disk was in contact with the table and hence the earth, it is neutral or at zero potential, the earth potential being taken as zero, Fig. 2.

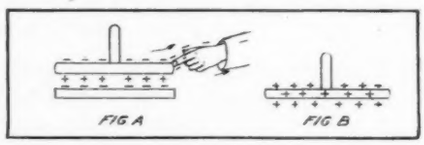


Fig. 4. Charged and Discharged Conditions.

(4). The negative (—) charges on the plate will attract the positive (+) charges, which already exist in the disk, to the lower side and will repel the negative (—) charges to the upper side of the disk, Fig. 2-*B*. In other words, the negative charges are trying to get away but cannot on account of the insulating handle. This is because electric charges behave the same as magnets (Fig. 3) in that "likes repel and unlikes attract."

(5). If we again raise the disk, the

charges will again combine and no charge can be detected. If, however, before raising the plate, we touch it with the finger, Fig. 4-*A*, the negative (—) charges will escape to earth, leaving the positive (+) charges on the disk.

(6). If we raise the disk, we will find that it has a (+) charge since the (—)

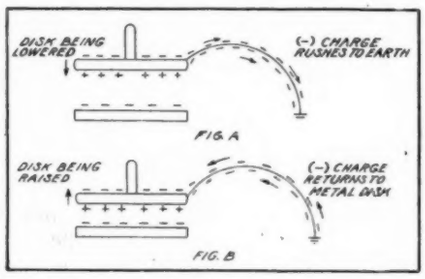


Fig. 5. Experiments to Show Electric Current.

charge, which escaped, cannot now return on account of the insulated handle (Fig. 4-*B*).

We can prove that none of this charge has been taken from the first plate by repeating this operation with the same results until natural leakage allows the first charge to gradually escape.

(7). So far this does not seem to shed any light on the action in which we are most interested—the behavior of a condenser when subjected to alternating current. However, let us suppose that the disk, instead of being insulated, is connected to ground by a wire. As the disk is lowered, the negative (—) charges will rush away to ground and *we have a "current" of electricity* (Fig. 5-*A*).

(8). As we raise the disk, the (—) charges return from earth and constitute a "current" in the opposite direction, Fig. 5-*B*, and we have a true "alternating current," the disk resuming its zero potential as at first.

(9). Now suppose that instead of a charged dielectric plate for the lower part of our apparatus, we had another metal disk, Fig. 6, insulated from earth but having a wire connection with a controller and battery by means of which we can raise or lower the potential at will.

On moving the controller handle to the first point, the plate, *A*, will naturally assume the same potential as the contact

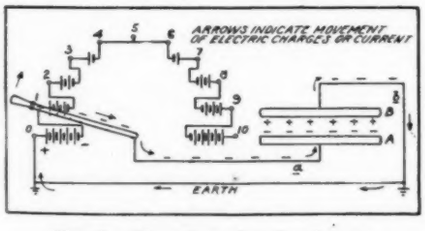


Fig. 6. Charging of a Condenser.

on the controller and negative (—) charges will rush over wire *a* causing a current flow toward the plate. These (—) charges repel an equal amount of (—) charges from plate *B* which escape by wire *b* to ground, causing a current flow away from the plate.

Thus it will be seen that while the outgoing current in the second wire is the counterpart of that in the first wire, yet strictly speaking, the current does not actually flow through the condenser, since all the original charge remains on plate *A*.

This action will charge the condenser just as we charge a storage battery, and, like it, the voltage of the condenser rises as the charge increases until a point is reached where it equals that of the battery. When this happens, the current stops and the charge remains constant, a fact with which we are all familiar in testing a condenser with a receiver and a battery (Fig. 7).

The first time contact is made, a sharp click is heard in the receiver due to the charging current. With the second tap, a slight click is heard, and with each successive tap this continues to decrease in volume until a point is reached where the condenser is fully charged and nothing is heard but leakage current, which should be very small.

As our controller is turned to the second point, a second charge is added to the first and a second charging current takes place, in this case, as we have drawn it,

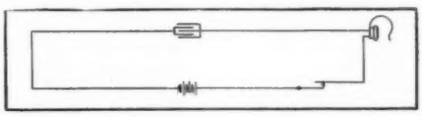


Fig. 7. Circuit for Testing Condenser.

being smaller than the first installment of current. This continues, gradually decreasing in intensity until the top of our arc, Fig. 6, is reached and we start down the other side.

Here the reverse action takes place and the current reverses in direction, since the voltage of the condenser is now greater than that of our battery. As the controller reaches the last notch, the current reaches its maximum discharge rate, for we have cut down our battery voltage by the greatest step.

Since the negative (—) charge in plate *A* is decreasing, the positive (+) charge in plate *B* will be no longer held and the (—) charges will return, giving a reverse current in wire *b*. In short, we have produced an alternating current in our circuit without an actual *conduction* through the dielectric.

(10). If we add another condenser in series with that of Fig. 5-*B*, we will have a continuation of this effect, Fig. 8, the negative (—) charge which is repelled from disk No. 2 passing over to disk No. 3, where it acts in exactly the same manner as the original charge on plate No. 1, causing a flow of current to ground through wire *c*.

If we placed a sufficiently sensitive galvanometer in the circuit in either *a*, *b*, or *c*, we would get a deflection in one direction as we charged plate No. 1 and in a reverse deflection as we discharge it. A telephone receiver will give a sharp click if it is included in the discharge circuit of Fig. 4-*A*, for instance.

Electrometers.

A highly sensitive instrument for detecting small electric charges is the "gold

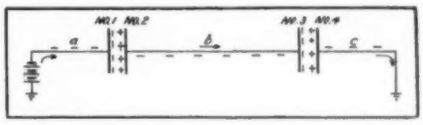


Fig. 8. Production of Alternating Current.

leaf electrometer." Two narrow strips of gold leaf are suspended from a wire which is supported in a glass jar to protect it from air currents.

If a charged body is brought near the plate of the electroscope, Fig. 9-*A*, charges of a like sign will be repelled into the gold leaves. The charges on the two gold leaves will repel each other, being of the same sign, since electric charges follow the same laws as magnets in that "likes repel and unlikes attract."

The charges produced in the foregoing experiments are very easily detected by means of the electroscope even when too feeble to produce sparks. If substituted for the ground in Figs. 6 and 7, a graphic idea of the movement of the electric charges is produced, the gold leaves diverging more strongly as the charged body is approached.

All the foregoing experiments can be readily performed with rough apparatus. A glass plate or phonograph record will furnish the original charge, a tin lid with a piece of sealing wax for a handle will suffice for the metal disk, and the electroscope can be made by using strips of thin tinsel paper or even tissue paper.

A very effective "electrophorus" can be extemporized out of a tin tray or lid, a glass tumbler and a sheet of brown wrapping paper. Warm the glass to insure its being a good insulator. Lay the tin tray on the glass so as to clear the table.

(a) Warm the brown paper.

(b) Draw it between your coat sleeve and coat to electrify it.

(c) Lay the paper on the tray and

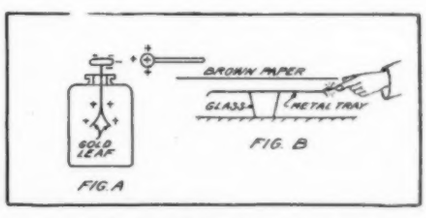


Fig. 9. Experiment with Electrophorus.

touch the tray with the finger. A spark of from 1-8-inch to 1-2-inch will be obtained, depending on the size and condition of the apparatus.

(d) Lift the paper and touch the tray

again and another spark will be obtained. (See paragraphs 1 to 6 for explanation of these effects).

The foregoing experiments show some of the effects of capacity and the reasons underlying them. The next step is to find out what effect changes in the various conditions will cause.

(1). *Voltage or Potential:* This can be illustrated by the analogy of water pressure. If we have a large reservoir and connect it to a small standpipe where

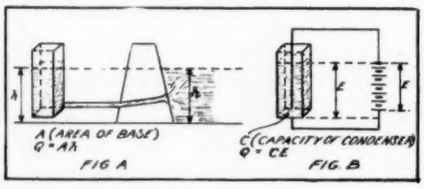


Fig. 10. A Capacity Analogy.

the base is even with the bottom of the reservoir, the height of water in the pipe will be equal to that in the reservoir.

The *quantity* of water in the pipe evidently depends on the area of the base and the height of the water (Fig. 10-*A*). Likewise in Fig. 10-*B*, the voltage across the terminals of the condenser will be equal to the voltage, *E*, of the battery.

We define the "capacity" of a condenser as being equal to the quantity of electrical charge which it will hold with a pressure of one volt. If we increase the voltage, we will increase the quantity in proportion, or $Q = C\ E$; $C = Q\ E$; and $E = Q/C$.

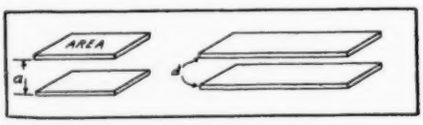


Fig. 11. Factors in Condenser Capacity.

The unit of capacity is called a "farad," but this is so large that in practice we use the 1/1,000,000 farad, or *microfarad.*

The *capacity* of any particular condenser, Fig. 11, depends on the following factors:

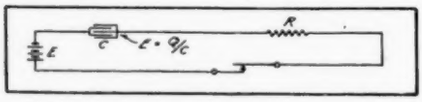


Fig. 12. Current in Circuit Containing Capacity.

(a). The *area* of the plates. A large plate will naturally have a greater capacity than a small one, other things being equal.

(b). The *distance* between plates. In the experiment with the electrophorus, we noticed that the effect became stronger as we brought the disks closer together.

(c). The *dielectric* or insulating material between the plates. It has been found by experiment that the capacity of a condenser can be changed as much as 8,100 per cent by changing the insulating material.

Let us represent the area by the symbol *A*; distance by *d*; and the effect of the dielectric by *K*. Then the capacity is proportional to the product of these factors or $C \propto K\ A\ d$.

Taking the value of *K* for dry air as unity, the relative influence of the various materials is given in the following table:

Substance	Value of *K*
Air	1.0
Paper, dry	1.5
Paper, treated	4.0
Paraffine	2.0 to 3.3
Ebonite	2.0 to 3.2
Petroleum	2.1
Transformer oil	2.5
Mica	4.0 to 8.0
Glass	4.0 to 10.0
*Water	81.0

* In the last item it may be remembered that *pure* water is one of the best insulators.

Ordinarily we deal with condensers in the form of flat plates or sheets, but any shape of conductor has capacity, the amount depending, as above, on the dimensions and surroundings. The capacity of some of the simpler shapes as disks, spheres, etc., can be computed, but that of irregular objects can only be approximated. However, it is often possible to set up a similar condition and actually measure it by comparison with a condenser whose capacity we either know or can compute.

The capacity of the earth, for instance, is about 700,000 microfarads, or 0.7 farad.

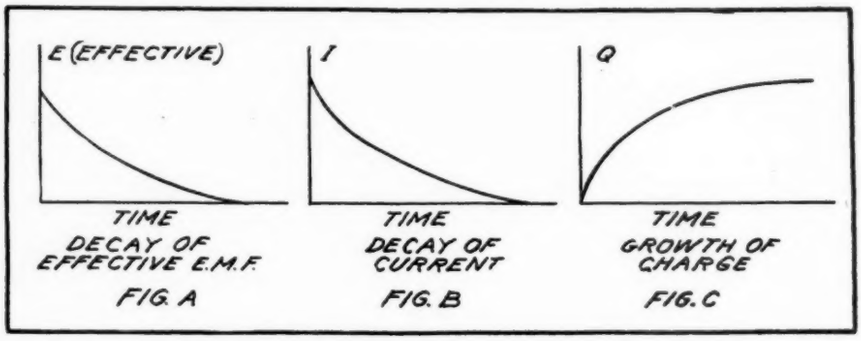


Fig. 14. Decrease of Effective E. M. F. and Current with Growth of Charge.

When we first apply the terminals of a battery to a condenser, we set up a rush of charging current whose value to start with is the same as if only the ohmic resistance were in the circuit (Fig. 12).

In this the condenser acts exactly as a completely discharged storage battery would and the current at the start is equal to E/R.

In paragraph (11) we found that $Q = CE$; $E = Q/C$; $C = Q/E$.

As the current continues to flow, the quantity will continue to increase and this will build up the potential as it would in a storage battery. Referring to Fig. 10-*B*, we can see that filling the condenser up, so to speak, raises its voltage as shown in the foregoing formula.

As this voltage rises, there will be effective at any particular instant, the difference between the battery voltage and that of the condenser (Fig. 13-*A*). The voltage effective at any instant is the difference between the voltage of the battery and the back voltage of the condenser. This is shown graphically in Fig. 13-*B* or by symbols.

$E_{effective} = (E_{battery}) - (E_{condenser})$ or $E_{eff} = E_b - E_c$.

As our quantity continues to increase, E_c will also increase and E_{eff} will, of course, continue to decrease (Fig. 14, *B* and *C*) and the current will decrease. The value of the current at any instant will always be $I_t = E_{eff}/R$

Alternating Currents and Condensers. In our experiment with the electrophorus we produced a feeble alternating current of a low frequency (depending on the rate of raising and lowering of the disk) Fig. 5, *A* and *B*. In Fig. 8 we produced an alternating current by means of a controller, the handle of which was operated by hand.

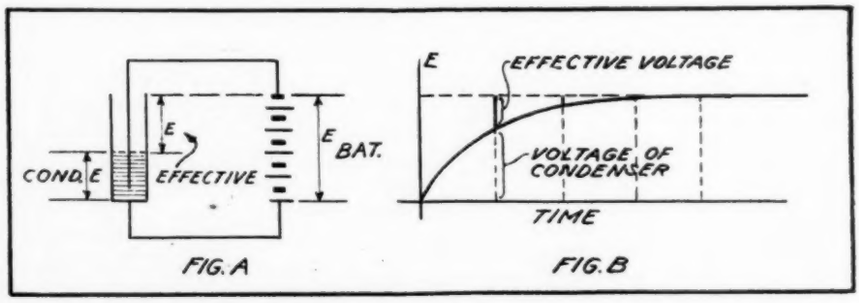


Fig. 13. Graphic Illustration of Voltage Effective at Any Instant.

In practical telephony on the other hand, we have two classes of alternating currents to deal with, ringing currents

which have some frequency within the range from 16 cycles to 133 cycles per second, and voice currents which range from 200 cycles to 2,000 cycles or more.

In the ringing generator, a conducting loop is rotated between the poles of a magnet and in cutting the magnetic field, an alternating E.M.F. is generated which, if the circuit is closed, will produce an alternating current. The magnitude of this E.M.F. at any instant is shown in Fig. 15-*A*.

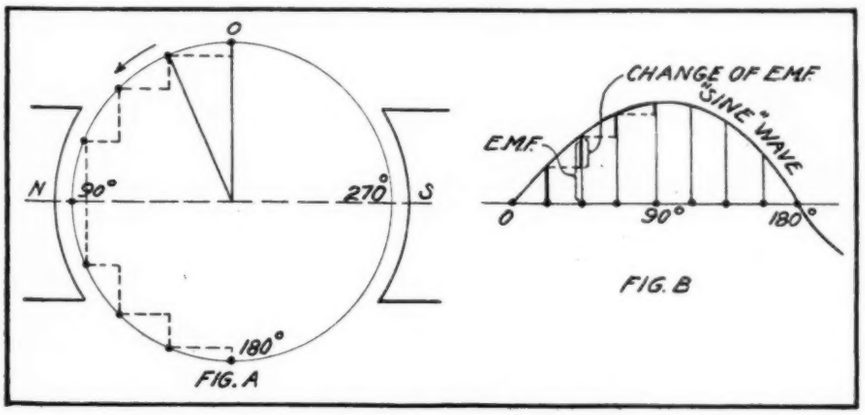


Fig. 15. Magnitude of Electromotive Force and Resulting Sine Wave.

Without digressing to describe this action in detail, it may be stated that the resulting wave is of the shape shown in Fig. 15-*B* and is called a "sine" wave.

Since the vertical steps represent voltages, we may represent the voltage steps, Fig. 16-*A*, by cells of battery, as we did in Fig. 8, the number of cells in each step representing the *change* in voltage in the corresponding step of the "sine wave." Taking the first half-cycle, we can draw our controller, Fig. 16-*B*, using the values as shown in Fig. 16-*A*.

When we throw our controller to the second point, we charge the condenser to the corresponding potential, which we will call E_2, since the quantity $Q = C\ E_2$. As each point is reached, the voltage is changed and the condenser will receive an additional charge. The total quantity will in each case be equal to $C\ E_t$ but *the change in quantity is in proportion to the change in voltage.* That is, we charge the condensers as fully as possible at any given voltage, after which the quantity will *remain unchanged* until we *change* our voltage.

To *change* our quantity of charges, we must have a *current* and the *greater the change of charge* in a given time, the *greater the current.*

Capacity.	X_c 16~	X_c 800~
0.1 M. F.	99,480 ohms.	1,999 ohms.
0.5 M. F.	19,896 ohms.	398 ohms.
1.0 M. F.	9,948 ohms.	199 ohms.
2.0 M. F.	4,974 ohms.	99.5 ohms.
4.0 M. F.	2,487 ohms.	49.7 ohms.
6.0 M. F.	1,656 ohms.	33.1 ohms.

Apparent resistance of condensers to 16-cycle ringing power and to 800-cycle voice currents.

If we take our current in the condenser as proportional to the *change of quantity* and plot a curve, we will get a result similar to Fig. 17. It will be noted that the current passes through its maximum (and other) values before the E.M.F. passes through its corresponding points, 90 degrees ahead of it in terms of rotation of our generator. Consequently, we say that *"the current in a condenser leads the E.M.F. by 90 degrees."*

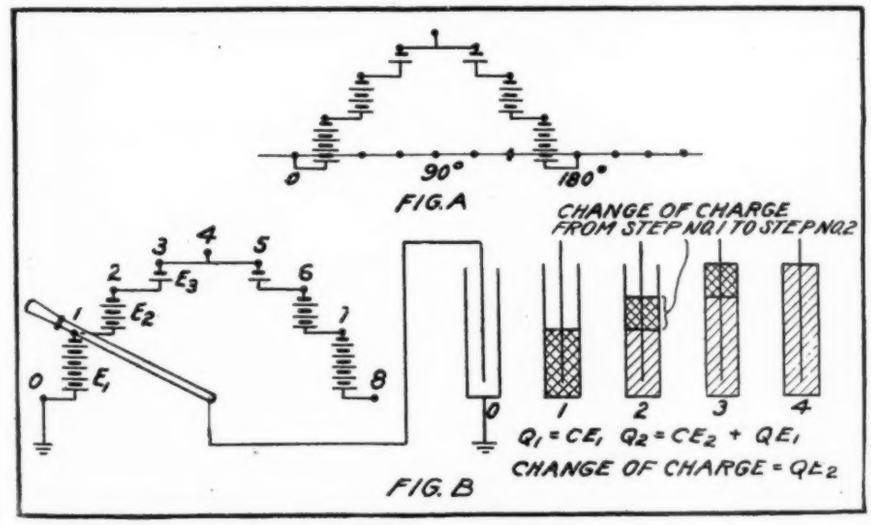


Fig. 16. Voltage Steps and Charging of Condenser.

Apparent Resistance of Condensers.

Aside from the fact that the current in a condenser is about 90 degrees ahead of the E.M.F., a condenser in an alternating current circuit acts like a resistance whose magnitude is

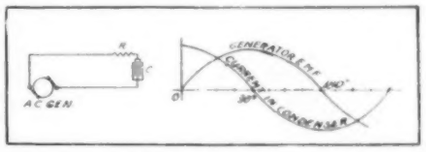


Fig. 17. Current Proportional to Change of Charge.

$$X_c = \frac{1}{2\pi f C}$$

where $\pi = 3.1416 = \dfrac{\text{Circumference of a Circle}}{\text{Radius.}}$

f = Frequency

and C = Capacity in farads.

Note that if capacity is given in microfarads, this resistance must be multiplied by 1,000,000.

The apparent resistance of any other condenser for the frequencies given in the table may be computed by dividing the value given for 1.0 mf. by the capacity of the given condenser.

A feature of this apparent resistance is that it does not permanently use up any energy. It merely stores energy for a quarter-cycle and gives it back to the circuit during the next quarter-cycle. In this it again acts like a storage battery, storing energy during charge and delivering energy during discharge. The reason the resistance appears smaller to the higher frequencies is that the amount of each charge depends on the voltage as we have proven.

If the condenser is charged and discharged slowly, only a small quantity of electricity will be handled in a given time compared to the amount that would be handled at a higher speed. It is like bailing water out of a boat with a dipper. If we work slowly, we do not handle much water, but the faster we work, the greater the volume of water handled.

Since $I = E/R$, the greater the current, the smaller the resistance must be and by referring to the table this would be found true—that is, X_c is proportional to I/C.

When a resistance is connected in series

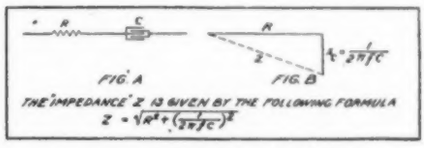


Fig. 18. Apparent Resistance.

with a condenser, Fig. 18-*A*, the apparent resistance of the two will equal, not the sum of the two resistances but the "vector sum," Fig. 18-*B*, which is the diagonal of a rectangle having one side equal to

the resistance and the other side equal to the "reactance" or apparent resistance of the condenser.

The impedance Z is given by the formula:

$$Z = \sqrt{R^2 + (\tfrac{1}{2}\pi fc)^2}$$

Problem:

What is the impedance at 800 cycles of

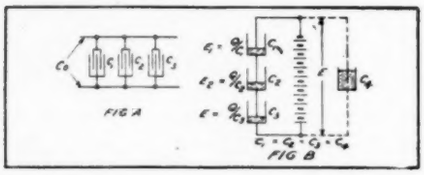


Fig. 19. Condensers in Parallel and Condensers in Series.

a 100-ohm resistance and a 1 m.f. condenser in series?

$$R = 100 \text{ ohms}$$
$$X_c = 199 \text{ ohms}$$
$$Z = \sqrt{100^2 + 199^2}$$
$$= \sqrt{10{,}000 + 39{,}601}$$
$$= \sqrt{49{,}601}$$
$$= 223 \text{ ohms (nearly)}$$

Condensers in Parallel.

Condensers in parallel, Fig. 19-*A*, form a very simple case. The resultant capacity is the sum of the various capacities:

$$C_o = C_1 + C_2 + C_3$$

Example:

What is the resultant capacity of a 1 m.f., a 2 m.f., and a 5 m.f. condenser connected in parallel?

$$C_o = C_1 + C_2 + C_3$$
$$= (1 + 2 + 5) \text{ m.f.}$$
$$= 8 \text{ m.f.}$$

Condensers in Series.

Fig. 19-*B* shows condensers in series and is a special case where the condensers are equal in value. We have previously found that $Q = C\,E$ or $E = Q/C = (1/C_o)\ Q_o$ in any condenser and hence this holds true for the resulting condenser as taken from the outside terminals.

Let us take a case where we have three equal condensers in series. Since the current is the same at all parts of the circuit at any instant, the total quantity of charge is the same in each condenser at any instant and, consequently, also is equal at full charge.

We cannot assign a value of Q as yet, but since the capacities are equal for the three condensers, we must have the total battery voltage evenly divided between the three condensers—that is, the voltage

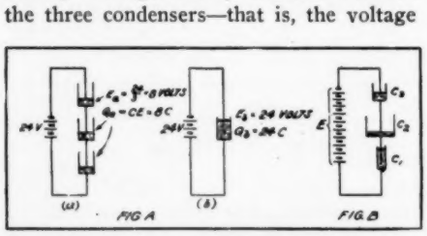


Fig. 20. Sum of Voltage in Condensers.

effective across the terminals of each condenser will be one-third of the total battery voltage E_o.

Since the voltage across each condenser is only one-third of the total voltage, the *charge in each condenser will be only* one-third of what it would be if the *full battery voltage* were connected to any one of the condensers alone.

Now we know that in single condensers the greater the capacity, the greater the charge or quantity for any given voltage and "vice versa" that the smaller the charge for any given voltage the smaller the capacity of the condenser must be.

Since the *charge* of the combination is only one-third as great as it would be for any one of the condensers taken singly, the *capacity* of the combination must also be one-third of the capacity, C, of any one of the condensers taken singly as shown graphically in Fig. 19-*B*. That is, for three equal condensers in series:

$$C \text{ (of combination)} = \frac{C \text{ (of one condenser)}}{3}$$

Likewise for N equal condensers in series:

$$C \text{ (of combination)} = \frac{C \text{ (of one condenser)}}{N}$$

$$C_o = C/N$$

In Fig. 20-*A* we have three m.f. condensers in series. The voltage of the 24-volt battery will be equally divided between

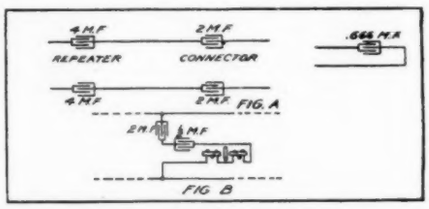


Fig. 21. Combinations of Condensers.

the three equal condensers, giving us 8 volts on each condenser.

Since we have only 8 volts effective on each condenser, we have only one-third the charge that one condenser would have if connected across the 24-volt battery. That is, the effective capacity of three 3 m.f. condensers in series is only one-third of the capacity of any one of them taken singly or 1 m.f.

General Case for Condensers of Different Sizes—Condensers in Series.

In Fig. 8 we found that the quantity, Q, of electrification "stored" in each one of the condensers is the same, the charge on the first condenser repelling an *equal* and *like* charge to the adjacent plate of the next condenser and so on throughout the circuit.

Since $Q = C.E.$ in any condenser,

$$E = Q/C$$

or $E = (1/C)\ Q$, which is to say that the larger the condenser, the smaller the voltage necessary to produce any given charge.

The sum of the voltages (Fig. 20-*B*) in all condensers must equal the voltage (E) of the battery.

$$E_o = \left(\frac{1}{C_1}\right) Q_o + \left(\frac{1}{C_2}\right) Q_o + \left(\frac{1}{C_3}\right) Q_o$$

$$E_o = Q\left(\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}\right)$$

$$E_o = Q_o$$

But $E_o = Q_o\ (1/C_o)$

Evidently then $\dfrac{1}{C_o} = \dfrac{1}{C_1} + \dfrac{1}{C_2} + \dfrac{1}{C_3}$

or $C_o = \dfrac{1}{\dfrac{1}{C_1} + \dfrac{1}{C_2} + \dfrac{1}{C_3}}$

Example:

What is the resultant capacity of a 1

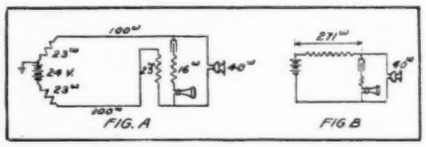


Fig. 22. Talking Conditions on Common Battery Line.

m.f., a 2 m.f. and a 5 m.f. condenser in series relation?

$$C = \frac{1}{\dfrac{1}{1} + \dfrac{1}{2} + \dfrac{1}{5}} = \frac{1}{1 + .5 + .2} = \frac{1}{1.7}$$
$$= .588 \text{ m.f.}$$

Combinations of Condensers in Practice.

The apparent capacity in the circuit, Fig. 21-*A*, will be the resultant of 4 m.f., 2 m.f., 2 m.f., and 4 m.f in series.

$$C = \frac{1}{\dfrac{1}{C_1} + \dfrac{1}{C_2} + \dfrac{1}{C_3} + \text{etc.}}$$
$$= \frac{1}{\dfrac{1}{4} + \dfrac{1}{2} + \dfrac{1}{2} + \dfrac{1}{4}}$$
$$= \frac{1}{1.5}$$
$$= .666 \text{ m.f.}$$

For a portion of a composite ringer as shown in Fig. 21-*B*,

$$C = \frac{1}{\dfrac{1}{C_1} + \dfrac{1}{C_2} + \text{etc.}}$$
$$= \frac{1}{\dfrac{1}{2} + \dfrac{1}{\frac{1}{2}}}$$
$$= \frac{1}{\dfrac{1}{2} + \dfrac{2}{2}}$$
$$= \frac{1}{.5 + 2}$$
$$= \frac{1}{2.5}$$
$$= .4 \text{ m.f.}$$

Action of Condenser in Common Battery Subset Circuit.

Fig. 22-*A* shows an average common battery subscriber's line under talking conditions. Fig. 22-*B* is a simplification,

(*Concluded on page* 26.)

Principles of Telephone Traffic

One of a Series of Articles Setting Forth the Fundamental Elementary Principles of Telephone Traffic Work—Every Operator and Manager Should Read These Articles—Operator Loads and Principles of Force Adjustment

By E. L. Gaines

Traffic Superintendent, Home Telephone & Telegraph Co., Ft. Wayne, Ind.

When the magneto multiple full manual board was the last word in large city central office equipment, a group of engineers in one of the largest exchanges in the country decided to make an operating test in an effort to discover if possible the maximum load that could be handled by an operator with that type of equipment.

Accordingly one section of the board was loaded with the busiest lines entering the office and the fastest and best-trained operators on the force were placed at the positions of that section during the peak load. Every possible effort was made to secure loading and operating conditions that were conducive to speed and the operators were enthused and spurred on by the thought of the possibility of making a record that would bring to them personal honors.

The average number of calls handled by each operator during the busiest hour of the test was well over 600, while the largest number of calls handled by any one operator in an hour reached nearly 700. This record was made with magneto multiple equipment with full manual features; that is, no automatic ringing, automatic listening, or any of the later improvements of the more modern common battery switchboard.

When asked what the test indicated, one of the engineers who helped conduct it answered: "It indicated absolutely nothing of value to us as telephone engineers. It merely satisfied our curiosity."

Most telephone operating men would be more successful and telephone service as a whole would be greatly benefited if more men understood, as did these engineers, that special tests of this nature have very little constructive value and usually do more harm to the service during the test than they ever do good.

What an operator can do, and what she can do *right*, are two different things. Also what an operator with specified equipment can do under the pressure of a special test is different from what she should be required to do day after day. An exceptional horse may run a mile in two minutes, but no one expects him to keep up the pace mile after mile or day after day.

The element of fatigue enters into all forms of exertion. Its effect upon the quality of work performed must be taken into consideration in the setting of any standard of labor. The physical and mental powers of every individual have certain definite and fixed limits to which one may go with impunity but beyond which actual damage is done to the individual if efforts are sustained and such damage nature will not readily repair.

Poisons are thrown out into the system by every physical or mental exertion, causing fatigue. When a certain degree of fatigue is reached, Nature demands a rest period during which the poisons may be disposed of and needed repairs to the worn tissues effected. If Nature's warning of fatigue is not heeded, the point of complete exhaustion, which may even result in death, is finally reached.

A proper amount of physical exertion is beneficial and necessary to the health of the individual. All forms of labor should be studied and the work so planned that the maximum amount of fatigue will be obtained without any harmful results. The most efficient operation will only be secured in this way.

Just how much work a telephone operator should do, just how many calls she should answer in a given period of time, cannot be determined without a careful study of everything affecting her work in any way. The light, heat and ventilation of the operating room and the spirit of the worker have, perhaps, more to do with the problem than even the equipment itself. Such simple details as these are often overlooked in making a study of the problem while checking up the manual operations necessary to the work of establishing a call.

In determining the number of operations required in completing a call in order to arrive at the proper operator load, it is necessary to take into consideration the class of service rendered and the type of equipment the operator has to work with, such as the type of keyshelf and the number of keys on the switchboard, the kind of supervision and any special features or equipment that may be provided.

Under classes of service are code-ringing party lines, selective-ringing party lines, straight lines, pay stations, etc. Each of the first three may be further divided into flat rate and measured service.

Under types of equipment to be taken into consideration are magneto and common battery in the small one and two-position boards, and in the larger boards, transfer, multiple and associated multiple types. In a multi-office exchange, the trunking percentage must also be taken into consideration.

The number of cord circuits must be considered, the number of keys per cord circuit, the type of key, whether the ringing is by individual or master key and whether or not the ringing keys are indicating keys. The later keyless operator equipment must also be considered as well as key shelves equipped only with emergency listening and ringing keys.

The type of supervision should be carefully checked. The amount of work an operator has to do depends very largely upon the amount of work the equipment does not do and thereby requires her to do. The supervision may be single or double ring-off drops in magneto equipment or the usual lamp supervision on common battery boards.

Flashing recalls and automatic disconnects are provided on many later boards. The dark keyshelf, or what is sometimes called dark supervision, is provided on many of the later special feature boards on which a light is never burning unless the operator's immediate attention is required. The line signals themselves must be taken into consideration on magneto boards that are not provided with self-restoring line signals. The same thing applies to magneto ring-off drops.

The special features which have been added to modern switchboards and which do so much towards lightening the work of the operator and thereby increasing her efficiency and ability to handle calls, comprise among other things automatic listening, which obviates the necessity of opening a listening key; automatic ringing, which does away with the requirement that the operator not only ring but continue to ring and supervise the connection until the called party answers; the revertive ringing tone, which notifies the calling subscriber that his party is

PUBLIC SENTIMENT.

Public sentiment is everything. With public sentiment nothing can fail; without it nothing can succeed. Consequently he who molds public sentiment goes deeper than he who enacts statutes or pronounces decisions. He makes statutes and decisions possible or impossible to execute.—Abraham Lincoln.

being rung, thus relieving the operator of that duty; and the flashing recall or automatic disconnect.

To these features may be added any special means provided for distributing the load of either originating or trunk traffic and also automatic call counters or peg-count meters.

It will be seen from the foregoing that consideration must be given to every detail of an operator's work and the entire switchboard equipment, as well as to the class of service rendered, in arriving at the proper operator loading. A careful study of the various types of equipment and the work necessary to handle a call with each will reveal proper coefficients to use in estimating changed loading, which may be brought about by contemplated changes in equipment or service.

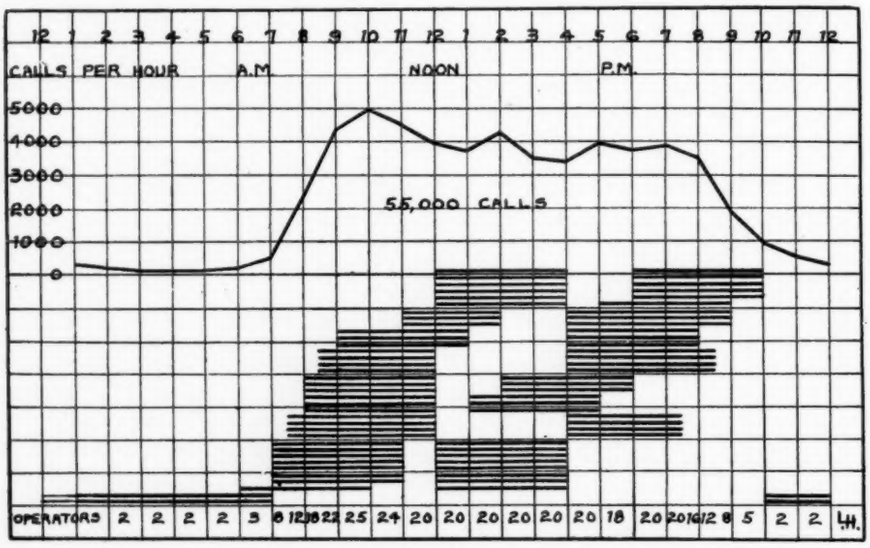


Fig. 18. Illustration of Variation of Operating Force With Traffic Load.

Since the number of calls an operator can handle in a given period depends largely upon the number of manual operations required of her in completing a connection, the more of the so-called automatic features provided, the less work will the operator have to do on each connection, and the larger the number of calls that can be handled.

In considering the various classes of service, attention must be given to the fact that more work is required of the operator for certain classes than for others, even with the same type of equipment; for example, code ringing on party lines requires more work on the part of the operator than straight-line ringing with the same equipment.

The same service requires more work with some classes of equipment than others, as for example, selective ringing with a master key requires more work than if individual selective-ringing keys were provided for each cord circuit, and non-indicating selective-ringing keys require more attention than indicating keys. Straight lines or jack-per-station party lines may be operated more easily than other classes of selective-ringing party lines or code-ringing party lines. Measured service, requiring the operator to make a record of each call, and pay station or coin collector service, slow down the operation materially.

Regardless of what equipment an operator may have to work with, she should be required to take care of only as many calls per hour as she can handle and give satisfactory service to her subscribers.

Too often we find speedy modern switchboards that are mechanically capable of handling more calls per hour than any operator can take care of with accuracy. Also we often find calls so congested on such boards that although the operators may handle double the number they formerly did on the old straight manual equipment, yet owing to the fact that the calls do not originate with periodic evenness, many calls must stand longer than advisable. The high speed at which the operator is required to work causes a higher percentage of errors than is permissible.

No traffic records of special tests are of sufficient value to merit consideration without showing the average operator answering time, average recall time, average length of conversation and error percentage. These averages must be taken from observations made of at least 1 per cent of the day's traffic. Unless the service is satisfactory to the subscriber in every way, the most rapid and economical operation will not be successful operation.

When the proper load per operator has been arrived at, an average of the daily load for the entire office should be determined from the peg counts. A sufficiently large number of peg counts should be taken into consideration to insure a fair daily average. Sunday loads should not be taken into consideration in making up the average daily load for the rest of the week but a separate average should be taken of Sunday peg counts which will give a fair Sunday average.

With the proper load of calls per operator and the average daily load for the entire office by hours determined, it is a comparative simple matter to make up a working schedule of hours for the operating force to handle the load effectively and efficiently at all hours of the day.

A typical case is shown in Fig. 18 where an average daily load of 55,000 calls is shown in combination with an operators' schedule designed to properly handle the load. Let us suppose that with the equipment in use in the office under consideration, each operator can properly care for an average of 200 calls per hour. Since the load from midnight to 6 a. m. never goes above 300 calls per hour, a night force of two operators is all that is required. A third operator comes on duty at 6 a. m., making a total force of three operators at 7 a. m. when the traffic reaches 500 calls per hour.

The force is increased to eight operators at 7 a. m. to take care of the load which reaches 1,500 calls at 7:30. At 7:30 the force is again increased to a total of 12 operators who handle the calls until eight o'clock when the force is again increased by six more until 8:30 and by four more at 8:30. Thus at nine o'clock we have a total of 22 operators handling 4,300 calls per hour and so on throughout the day, the force being varied as the average load varies.

While it is true that the actual load does not correspond with the average load at all times, yet owing to the fact that each operator can handle from 10 to 25 per cent additional load for a short period without seriously affecting the quality of the service rendered, such fluctuations of the load are automatically taken care of. A great deal of thought should be given the arrangement of an operating schedule in order to provide working hours that are as convenient and agreeable as possible for the operators themselves and at the same time take care of the traffic.

Many states now have laws which limit the operators' working day to eight hours. The schedule should be so arranged that no operator is on duty more than four hours at a time and an interval of at least one hour should be allowed between the two four-hour working periods. Rest periods of from 10 to 15 minutes should be provided during each four-hour work period.

What is sometimes termed "standing relief" should be arranged by the chief operator at least twice each day. During this period the operators are allowed to stand at the switchboard, the chairs being drawn back away from the board by

the supervisors. It is usually advisable to have the windows of the operating rooms opened and fans turned on for a few minutes during the standing relief.

The change of position afforded by the standing relief tends to break the monotony of the operator's work and assists materially in keeping up the speed of the service.

New Telephone Cable Is Laid With Ceremony.

Improved telephone service will be rendered between Detroit, Mich., and Windsor, Ont., Canada as the result of the recent laying of a 3,000-foot cable in the Detroit river, according to officials of the Michigan State Telephone Co.

The laying of this cable, the fourth to span the river for telephonic purposes was marked with a ceremonial. The cable boat, to which was attached a tug, was festooned with American and British flags. Among its passengers were officers of the Michigan State company and the Canadian Bell Telephone Co. The event was made possible only after approval had been given by the two governments.

Harmonious and Efficient Service, Secret of Success.

If you remember, when the Nebraska State Railway Commission in May granted the Arnold Telephone Exchange's petition to lower rates, the commissioner stated in the order that the company was to be congratulated on the very efficient manner in which it was operating its exchange and the arrangements made by which it had been able to operate at less expense than most exchanges of equal size.

"Part of this is due," says the order, "to the very happy manner in which the country lines being switched at Arnold hire the linemen of the company to do their line work and thus reduce the burden against the company for maintenance of linemen."

We asked the Arnold exchange how they made their record and have received some interesting information from G. D. Morse, who is manager, lineman, and troubleman for the company, and who does considerable work for the farm line companies which makes a net earning of about $250 for the year.

Mr. Morse checks the toll statements and handles other work of this kind, except collecting for which he pays $35 a month. Collections are made in advance and if the bills are not paid by the tenth of each month the subscribers are disconnected and a charge of $1 to connect again is made.

"Our aim," says Mr. Morse, "is to keep employes satisfied, and we all work to satisfy the subscribers and give them the best service we can. I want to say that they appreciate it and work in harmony with us. I know of some companies that let their employes abuse the subscribers, where if they would treat them kindly, they would get the same in return with very few exceptions and there would be harmony instead of discord.

"We have good instruments, mostly Stromberg-Carlson. We also have two No. 105 Stromberg-Carlson switchboards which are satisfactory and give excellent service. I believe some companies make a big mistake in buying poor instruments and material. There is poor service and there are dissatisfied customers when such material is used.

"One reason for our light expense is that our officers' salaries are very light, there being only the directors' salaries and payment for the time I actually use as manager, which is very light. Our aim is to save as much as possible and operate our exchange as cheaply as possible, without sacrificing good service.

We appreciate the liberality of our subscribers and hope that they will do their best to make this year as prosperous as the last one."

Mr. Morse adds that while he has a nice little exchange there are many like it in the state and he does not see why other exchanges should not be able to make as good a record as the Arnold organization.

LIFE'S BROKEN THREADS

By Miss Anne Barnes.

Travelling Chief Operator, Iowa Independent Telephone Association, Des Moines, Iowa.

In no place in the world do we see the broken threads of life, which have become tangled, so much as in a great railway station. Every thread represents a chapter through which some mortal is passing and in which many have stumbled and been retarded in progress.

In this great human stamping ground, we see persons of every conceivable type and character. All have been influenced by some force, which has brought to bear upon them, for either better or worse. There is a large amount of similarity between those who have been changed either way. Most of the shifts in character have been brought about by environment or habits. These lives of the misguided ones are now broken threads which show a decided tendency to tangle.

So many of the threads which we observe, we can easily see the cause of the breaking. Here is a man with an empty expression on his face. Still, it seems to have the redeeming feature of good humor. He is undoubtedly the man who is always waiting for something to turn up. His whole dependence is upon luck. The only good which he renders the world is through being an optimist, but as for actual service, his output is negative.

For what does this next man live? His face is strong, too strong. At first glance we can pick him for the man who sees no humor in life. His dark over-hanging brow and wrinkled forehead seem to make it doubtful if he ever smiles. If he tried to smile, it would probably be a poor attempt, no better than a grin. His thread is a strong one. When it becomes tangled, the other threads suffer in consequence; for nothing of his will be allowed to suffer for others.

Who is our next example? This man with the tiny pig-like eyes who is constantly peering about him. His face seems to be constantly leering at those about him. He it must be who tells our friends the strange tales about us. He lives upon the gossip which he can absorb and pass on. The assimilation of news is his diet but the publication of it is his recreation. If his thread becomes tangled, it stays but long enough to draw others into the mesh and depart unscathed.

We are able to see all of these and many others such as greed, selfishness, disillusionment, good unfulfilled intention, false starts, etc., as we pause in a crowded waiting room.

I often think of the great variety of types of humanity—good, bad and indifferent—with which telephone operators come in contact daily. How fortunate it is that we are not obliged to meet all of them personally. We pass on and forget them in a railway station and at the switchboard.

Convention of Telephone Pioneers of America at St. Louis.

Announcement is made that the eighth meeting and the 10th anniversary celebration of the Telephone Pioneers of America will be held at St. Louis, Mo. on Monday and Tuesday, October 24 and 25. Information in connection with the entertainment, hotels, railroad rates, special train, etc., may be secured by writing Secretary R. H. Starrett at 195 Broadway, New York City.

Plans are being made for making this the greatest "Get-Together" meeting in the history of the association.

What Is Your Company Doing?

Chats About Company's Doings.

By Stanley R. Edwards.

Many a person at the switchboard has longed for a good squirt gun that would scatter well through the swarms that rush to the telephone and ask "Where's the fire?" when the alarm sounds.

The management of the Home Telephone Co., Joplin, Mo., recently announced that its operators were instructed to refuse information as to location of a fire, politely but firmly. To demonstrate the reasonableness of the order, members of the city commission and the local press were invited to witness the travail of the operators, when an alarm sounded.

It had been arranged for the power house to give the regulation fire signal, which included the ward, and the operators at the switchboard were directed to reply, "False alarm," to all queries as to the location of the fire. The reporter for the Daily Express gave a most dramatic description of the scene, pointing out what results might be expected if the company did not discontinue giving out the location of fires.

A suggestion has been made that, after the fire department has been called out, the telephone exchange give the location of the fire to some central business house, where it will be chalked on the board. Then those who feel they must know "right off" where the fire is can walk around to the board and find out.

"Telephone Costs" is the name of a neat little folder which the Home Telephone & Telegraph Co. of Fort Wayne, Ind., has had prepared and mailed to subscribers with their July bills. The illustration shows the title page and its arrangement. The entire leaflet is printed with dark blue ink, five pages being required to carry the message which reads:

"The cost of giving telephone service increases rapidly with the size of a telephone system. In almost every other business unit costs decrease as the business grows larger. Why it is necessary to charge more for service as a telephone system increases in size is a matter so little understood by the average telephone user that we believe a few words of explanation will be welcomed by our subscribers.

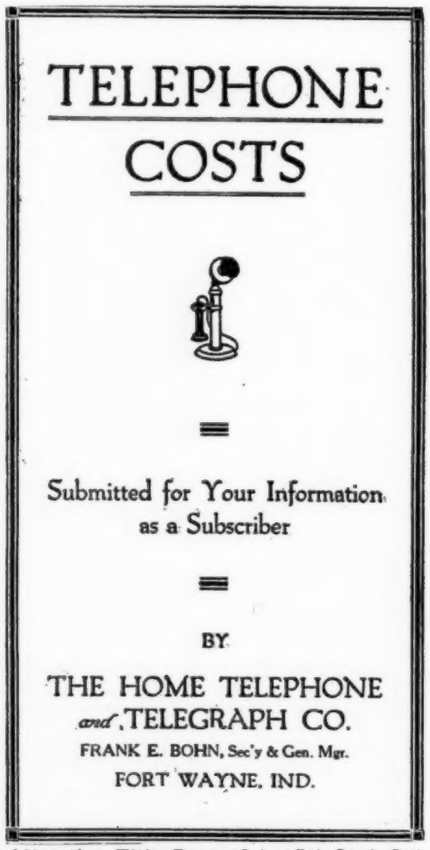
For the sake of clearness, let us consider a comparison of some of the main features of our two exchanges—the one in new Haven, Ind., and the one in Fort Wayne.

Operating Costs.

"Our New Haven exchange has 474 subscribers. Each of these 474 subscribers has the opportunity of talking with 473 other subscribers. Each subscriber uses his telephone an average of 2¼ times per day.

In Fort Wayne, with 20,000 subscribers, each may talk with 19,999 others. The daily calling rate in Fort Wayne is 6¾ calls per subscriber per day, or just three times the New Haven calling rate.

It, therefore, costs three times as much per telephone for operators in Fort Wayne as it does in New Haven, because an operator can answer and complete only so



Attractive Title Page of Leaflet Sent Out With Monthly Bills.

many calls in any period of time. In reality it costs more than three times as much, since it is necessary to pay higher average wages in a larger city.

The cost for operators' wages alone for some of the busiest lines in Fort Wayne amounts to more than the entire monthly rental charge. An increased number of calls per telephone also means an increase in the wear and tear of the equipment and, therefore, an increase in the maintenance and electric power used per unit.

Investment Costs.

"Another item of cost which increases with the size of the system, is that of central office equipment. In our New Haven office, each line is terminated in one place on the switchboard. In our Main office in Fort Wayne, each line must be terminated on the switchboard in 16 different places in order that all of the operators may have access to it.

This, therefore, means more complicated and expensive equipment as the exchange grows. As each new line is added, it must be terminated in 16 different places. Then as the exchange grows, these 16 places must be increased to 17, then 18, 19, etc., ad infinitum.

When the growth reaches the point when the 17th place must be added, it means that the entire number of lines must terminate on the 17th place as well as the other 16 and so on. So the addition of each new line means more equipment must be added to the lines already in service. So that the larger the exchange, the more expensive the equipment per line from this cause.

Trunking Costs.

"In addition to this extra investment, expensive trunking equipment must be provided to relay calls between the two offices in Fort Wayne, since the system here is so large that all of the lines cannot be terminated in one office.

This means that two operators instead of one are required to handle each call between the two offices and that the cost of handling these calls is doubled. Twenty-eight per cent of all calls in Fort Wayne are handled by two operators. This also increases the operating costs.

As Fort Wayne grows, it will be necessary to add a third and possibly a fourth office. This, in turn, will increase the operating costs per unit. As the city grows and the number of offices increases, the percentage of calls handled by two operators increases which, in turn, adds further to the operating costs per unit.

Length of Lines and Amount of Underground.

"The average length of the subscriber's telephone line is another factor which materially affects the cost. In New Haven the average length of each line is about 1,000 feet, while in Fort Wayne the average length of each line is considerably over one mile.

Each line is, therefore, more expensive to build and, being longer, costs more to keep free from trouble. Also the larger the city, the more the necessity for an expensive underground system which runs into large sums of money and adds to the cost of investment per telephone.

Conclusions.

"It will be seen from these figures, therefore, that not only is the investment per telephone greater in a larger system and increases as the system grows, but the unit cost of maintaining the system

as well as the unit operating costs also rapidly increases with the size of the exchange.

From this it will be seen why it is necessary to charge more for service as the city grows, and why it is necessary to increase rates as the system increases in size. The fact, too, that the value of this larger service to the user also increases more rapidly than the cost to him in the rates he is paying, should not be overlooked.

The Home Telephone & Telegraph Co.
Frank E. Bohn, Sec'y and Gen. Mgr."

The New York Telephone Co. has commenced a new series of constructive "inform-the-public" advertisements in the New York daily papers. The accompanying illustrations show the style of the ads which occupy four columns and are about a half a page deep.

The illustrations catch the eye immediately one looks at the page upon which the advertisement is printed. The subject matter, being in large type, is easily read so that even the casual reader of the newspaper is quite certain to supplement the story told by the illustration by absorbing the accompanying information.

"Telephone Houses" are the latest development in the stock-jobbing game in New York City.

A few years ago the mails "brought home the bacon." Despite the efforts of the post office inspectors, the mails are still employed, but the results are not

The Telephone Job When New York Moves in May

MAY 1st to you means one day of moving—the climax of weeks of preparation.

To us it means the high point in a huge two-months' job of moving telephone equipment and installing it in subscribers' new locations.

Each year, from April to June, this work must be done under continuous high pressure. This year we had to handle 77,000 orders for the connection, disconnection and relocation of telephone apparatus.

A single order meant moving from one to 150 telephones, a small monitor switchboard or a big private branch exchange. Hundreds of buildings had to be surveyed to determine the exact nature of the changes to be made.

Working on an emergency basis, our plant men broke all records for the May moving period—an achievement in service to New York City that shows how earnestly every telephone employee is working to again give you *telephone service when and where you want it.*

NEW YORK TELEPHONE COMPANY

One of a Series of Educational and Informative Advertisements Published Last Month in New York City Newspapers.

very satisfactory. The "voice over the wire" is safer and surer, and a long distance call has a certain psychological effect that holds the ear of the victim to the receiver.

There is something important about a long distance call that demands attention. And the stock salesman can promise anything over the wire, because there is no written record of the promise to confront him later.

In the Wall Street district are various "Telephone Houses." One of the biggest is close to the sub-treasury, J. P. Morgan & Co., the National City Bank and other leading financial institutions. This concern, it appears, never sold anything that brought a penny to an investor. Its entire organization is engaged today in selling a certain security "over the phone" at $10 a share, its par value, at a time when the same security can be bought in the open market for $1.25 a share.

It employs a score of "telephone men" who, from 9 a. m. to all hours of the night, sit at the telephone and talk to "prospects" in every part of the country. The range of one salesman in a day's work may run from the wilds of Maine to Southern California.

The concern pays a big sum for telephone tolls, but does not give the item a thought, as one sale, at a profit of 800 per cent., leaves a tidy sum after the salesman takes his 20 per cent commission and the telephone tolls are paid.

Scattered throughout the district are a number of smaller concerns which "contract" to sell securities. These concerns are not interested in the value of the securities they handle. The most important point to them is the "cut." It is as easy for them to dispose of a worthless security as one of real value, and the "cut" in the sale of the former is, of course, more attractive.

They are not interested in the future of the security because they do not intend to tell the victim the truth. Their business is to sell. They do not hesitate to tell the victim over the wire that the security will "double in value within a week," "that they can guarantee to sell it for the purchaser within a week for twice what he pays," that "it will be listed in ten days."

When the victim discovers that he has been swindled, he makes a complaint, which goes to the "kick department." Usually, if he isn't very careful, and if he hasn't left his check book at home, he is "reloaded." Only in rare cases, in which the complainant cannot be placated by any other means, is his money refunded.

To the average man it may seem incredible that intelligent, conservative business and professional men should fall for the lure of the telephone sharks. Perhaps the "average man" has not as yet received a call. But the telephone salesman will get around to him—if he has a telephone—and when the salesman gets him on the wire, he will get a taste of the temptation that may not leave him quite so incredulous.

"Easy money" is the bait dangled before the victims. The desire of most men to "pick up a little extra" leads them into the adventure in fatal finance. Many investors, or prospective investors, big or little, are natural gamblers. They are

TELEPHONE SPLICING—
A Big Job-Requiring Skill and Patience

Have you ever stopped by an open manhole and looked down at the telephone splicer at work?

With amazing swiftness his nimble fingers pick the right wires from among the 2400 in one large cable and join them with the proper wires in a new length of cable. Each connection must be insulated, boiling wax poured over it, and finally the "sleeve" drawn over the new joint and soldered.

Splicing wires in telephone cable may seem to be a small part of the task of supplying new telephone service in New York City. But it is exceedingly important work. 538,000 miles of new wire have been added to the city's telephone system since January 1, 1920. More than 10,000,000 splices had to be made before the lengths of cable containing all the wire could be connected to provide new tracks for talks trains.

The work of the splicer illustrates the intricate, painstaking character of the work of building up the city's telephone system to again provide telephone service when and where you want it.

NEW YORK TELEPHONE COMPANY

Directing Attention and Then Thought to An Operation Which May Be Seen in Any Moderate-sized City.

willing too take a "flier" if they can get in "on the ground floor."

The average telephone salesman can almost convince them that they are actually robbing themselves by failing to take advantage of the opportunity to become "independent overnight." They would not listen to him a second if he tried to sell them Liberty bonds at a 50 per cent discount or talked about any standard security. They bite at the highly speculative unlisted stocks when assured that it is the "opportunity of a lifetime."

It is a pleasure to welcome the latest magazine for telephone employes, "The Telephone Echo," published by the Manitoba Government Telephones.

"The Telephone Echo" is an attractive 32-page journal, profusely illustrated, and edited with care and discrimination. Its pages, size 6¾ by 9¾ inches, contain a fund of information for employes of the Manitoba Government Telephones and cover the various problems and activities.

Telephone service in general, directory development, and news from the exchanges occupy important space in the second number, the July issue, of this live little book. Several pages are dedicated to the employes of the company who were in service during the World War.

"The greeting given the first number of "The Telephone Echo" has been warm and general," says its editor, Lt.-Col. W. A. Dyer, of Winnipeg, Can. "We started this paper with a strong desire that it should have a 'get-together' influence, and the result has exceeded our expectations."

We shall look forward with interest to receiving copies of this worthy medium.

Some Factors in C.A.X. Economy

The C.A.X. is simple and inexpensive to install—Modified to meet the simple needs of rural communities, the C. A. X. switchboard embodies only such apparatus as will insure satisfactory service. All calls—incoming and outgoing toll, rural, party and individual line—are cared for by one simple type of switch.

The C. A. X. needs no operators—All local calls are set up by means of the dial on each automatic telephone. Toll or other calls requiring the services of an operator are trunked to the main exchange by dialing a special number.

The C. A. X. is easy to maintain—Infrequent visits by an equipment man serve to keep the C. A. X. in good condition. A simple automatic device cares for battery charging and voltage regulation.

The C. A. X. uses common battery, eliminating the expense of dry cell renewals.

AUTOMATIC EL

FACTORY AND GENERAL

ERANC

New York City 21 East 40th St.
Cleveland 415 Cuyahoga Bldg.
Philadelphia The Bourse Bldg.
Columbus 516 Ferris Bldg.
B 445 Tr

ASSOCIAT

INTERNATIONAL TELEPHONE SALES

International Automatic Telephone Company, Ltd., London
Compagnie Francaise pour l'Exploitation des Procédés T

Please tell the Advertiser you saw his Advertisement in TELEPHONY.

Some Features of C.A.X. Service

The C. A. X. operates continuously—Its facilities are available at midnight as well as by day; on Sundays and holidays as well as week days.

The C. A. X. sets standards of service that are beyond the reach of commission rulings. C. A. X. service is just as rapid, accurate and uniform as that in city automatic exchanges.

The C. A. X. meets all subscriber requirements—The same switchboard serves rural, individual line, and party line subscribers, with equal facility.

These and other service features of the C.A.X. ensure the public support necessary to the welfare of a telephone company, and facilitates upward rate re-adjustments when necessary.

LECTRIC COMPANY

AL OFFICES: CHICAGO, ILLINOIS

ANCH OFFICES:

B... 5 Tr...dg. | Rochester 519 Arlington Bldg. | Detroit 525 Ford Bldg. | Pittsburgh 608 Fulton Bldg. | Kansas City 1001 New York Life Bldg.

IAT...PANIES:

ES A...INEERING CORPORATION, New York

...s T...Houston, Paris | Automatic Telephone Mfg. Co., Ltd., Liverpool | Automatic Telephones, Australasia, Ltd., Sydney

ELECTRICAL CAPACITY—CONDENSERS.

(*Concluded from page* 18.)

showing the ohmic resistances of the various parts of the circuit.

Fig. 23-*A* shows graphically the drop

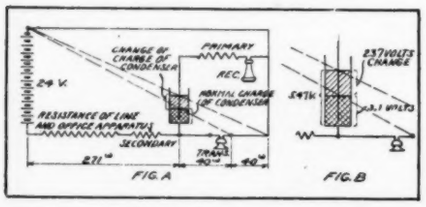


Fig. 23. Voltage Drops Due to Different Resistances.

in voltage due to the different resistances in the circuit. Each element of resistance may be said to use up a certain amount of the voltage supplied by the battery. The amount of voltage used up or the "potential drop" in any portion of the circuit will be proportional to the resistance of that portion. In the arrangement shown, the total resistance of the circuits is 271 + 40 ohms = 311 ohms, which "uses up" the entire battery potential of 24 volts.

The transmitter will "use up" its share of the voltage, which in this case is 40/311ths of 24 volts = 40/311 × 24 volts = 3.1 volts. The condenser then will be charged to a potential of 3.1 volts, Fig. 23-*B*.

Now if we talk into the transmitter, we change its resistance. For purposes of illustration, let us assume that the transmitter resistance increases to 80 ohms. The total resistance will now be 271 + (40 + 40) ohms = 351 ohms and the voltage across the transmitter will increase to 80/351ths of 24 volts = 80/351 × 24 = 5.47 volts.

Effective Change of Voltage (5.47—3.1) volts = 2.37 volts.

The condenser charge will increase correspondingly and the charging current will flow through the primary of the induction coil, producing a "booster" effect on the line current. All this, of course, is in addition to the actual current change in the line due to the change of line resistance.

Capacity of Cables and Open Wires and Its Effects on Transmission.

A pair of wires whether in a cable or in open wire may be regarded as a condenser, each wire being regarded as one plate of the condenser.

This capacity is distributed uniformly along the line, each little portion of conductor contributing its share. To be strictly accurate, we would have to represent this capacity by an infinite number of small condensers distributed along the line, but in practice it is sufficiently accurate to lump these effects and to represent the result as in Fig. 24-*B*, points one mile apart being usually taken.

The mutual capacity between the two wires of various types of conductors is approximately as follows:

	Per mile.
No. 24 gage cable	.078 m.f.
No. 22 gage cable	.074 m.f.
No. 19 gage cable	.074 m.f.
No. 19 Standard cable	.054 m.f.
No. 14 Duplex (approx.)	.018 m.f.
No. 12 Copper (open wire)....	.0081 m.f.
No. 10 Copper (open wire)....	.0084 m.f.

It will be seen that a telephone line of any great length has a considerable amount of capacity bridged across it. This acts somewhat as a bridged non-inductive resistance, and shunts out the voice currents in much the same manner.

The fact that this effect acts at 90 degrees from the E.M.F. (speaking in terms of rotation of our ideal generator) tends also to distort the voice waves and make them unintelligible to the ear.

The corrective measures include adding loading coils and with that in mind another article will take up the subject of "Inductance."

Appendix.

Derivation of the formula for Capacitive Reactance:

$$X_c = 1 \div 2\pi fC$$

Alternating currents are expressed in terms of their maximum values as follows:

$$E = E_{max} \sin \theta$$

and for non-inductive resistance:

$$I_{max} = \frac{E_{max}}{R} \qquad \text{(Ohm's law)}$$

From which

$$R = \frac{E_{max}}{I_{max}} \qquad (1)$$

That is, the value of the E.M.F. or of the current at any instant is obtained by multiplying the maximum value by the sine of the angle corresponding to the position of the conductor at that instant.

We have shown that the current in a condenser is at a maximum when the E.M.F. is zero, which is when $\theta = 0$.

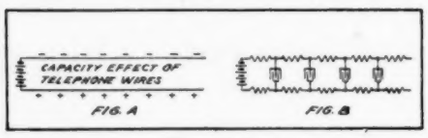


Fig. 24. Capacity of Cables and Open Wires.

Suppose our conductor, Fig. 25, to have revolved through a very small angle $d\theta$ in a very small interval of time dt.

Then $E_{dt} = E_{max} \sin d\theta$ and since for small angles $\sin d\theta = d\theta$, we may write

$$E_{dt} = E_{max}\, d\theta \qquad (2)$$

The angle covered by the conductor in a complete revolution is $= 2\pi$ "radians" and since we have f cycles or revolutions per second, the angle covered in one second is $\theta_{sec} = 2\pi f$

and the angle covered in any given time, t, is $\theta_t = (2\pi f)t$

For our very small angle $d\theta$ and time dt

$$d\theta = (2\pi f)\, dt \qquad (3)$$

Substituting this value of $d\theta$ in (2) we have

$$E_{dt} = E_{max}\, (2\pi f)\, dt \qquad (4)$$

Now we have found that in any circuit carrying current the quantity of electricity in coulumbs = amperes × seconds or

$$Q = It.$$

Also we have shown that in a condenser

$$Q = CE$$

Therefore $It = CE$ (5)

This is strictly true only when our current remains of uniform value throughout

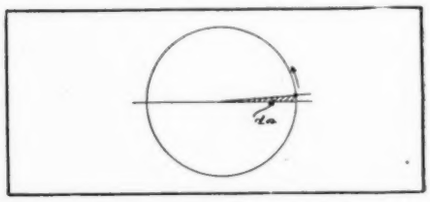


Fig. 25. Movement of Conductor.

the time considered, but since we have taken our angle so very small no error will be introduced by considering that $I = I_{max}$ throughout the length of time dt.

Substituting I_{max} for I and $E_{max}(2\pi f)\,dt$ [from (4)] in (5) we have

$$I_{max}\, dt = CE_{max}(2\pi fc)\, dt$$

$$\frac{E_{max} dt}{I_{max} dt} = \frac{1}{2\pi fc}$$

$$\frac{E_{max}}{I_{max}} = \frac{1}{2\pi fc} \qquad (6)$$

From (1) $\frac{E_{max}}{I_{max}} = R$ (for non-inductive resistance). Therefore, we may regard the term $\frac{1}{2\pi fc}$ as the "apparent resistance" or preferably as the *"capacitive reactance"* of the condenser.

Representing the "capacitive reactance" by the symbol X_c we have,

$$X_c = \frac{1}{2\pi fc}$$

Citizens (Mich.) Company Declares Quarterly Dividend.

Directors of the Citizens Telephone Co., of Grand Rapids, Mich., have declared the usual quarterly dividend of one per cent to stockholders, paid July 20. This is the company's 96th consecutive dividend covering a period of 24 years and representing a total disbursement of $4,000,000.

When the company was organized, the capital was $100,000 and the dividend rate 8 per cent. With the growth of the company, the capitalization increased, so that it now is $3,850,000 with an additional $950,000 in bonds outstanding. The company is also offering $300,000 more in bonds to finance growth.

Approximately 18,400 subscribers are served by the company in Michigan and it is said to be growing at the rate of about 1,000 a year. The dividend on the stock was reduced from 8 to 6 per cent in 1913 and two years ago dropped to 4 per cent.

Independents of Washington Meet

Two-Day Convention of Independent Telephone Association of Washington Held at Sunnyside Last Month — Practical Talks by Practical Men the Feature of Meeting — Plans Made for Building a Greater Organization

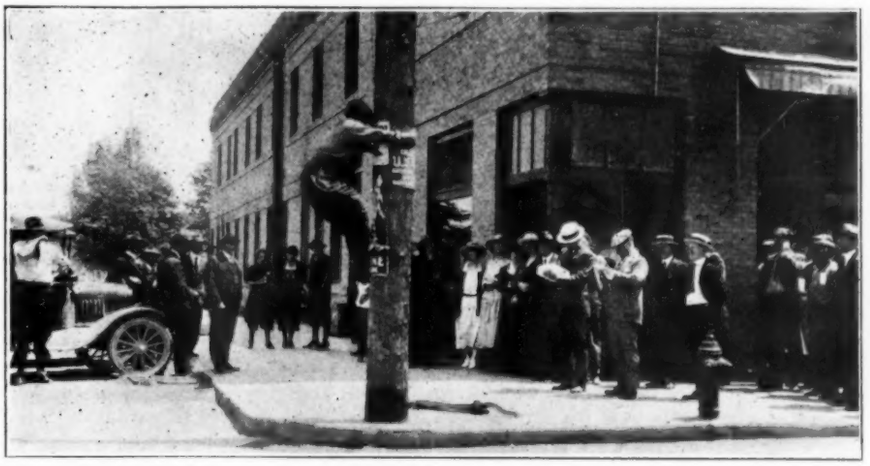
From all over the state of Washington, enthusiastic telephone men and women members of the Independent Telephone Association, of Washington, rolled into Sunnyside on June 15, for a two-day meeting and election of officers.

With the weather ideal, the gathering in good spirits, and the discussions and displays interesting, the meeting was declared to be a big success. The following officers were elected: John King, Puyallup, president; J. C. Ruth, vice-president; Edwin F. Keyes, Sunnyside, secretary and treasurer. The directors are: Mrs. Kate Glover, Concrete; E. M. Moore, LaPortage; A. T. West, Spokane; D. C. Wilkinson, White Bluffs; R. C. Brennesholtz, Pullman.

Convention headquarters were in the Planters Hotel and the meetings were held in the town hall nearby.

The first session of the 1921 meeting was called to order at 1:30 p. m., on Wednesday, June 15, by the president. An interesting explanation of the theory of transpositions was given by W. D. Scott, of Seattle, and this was followed by a general discussion of the theory.

J. E. Burch gave a talk on the proper methods of getting examinations and preliminary surveys for a toll circuit, and W. W. Hardinger, consulting engineer of Portland, Ore., read a paper on the appraisal of telephone property with reference to rate-making.



Concrete's "Linewoman" Was Winner of the Pole Climbing Contest.

The president then introduced A. T. West, of Spokane, who took up the subject of co-operation of the public with the company, and handled it most capably.

In the evening, the Commercial Club of the city of Sunnyside took the visitors on a motor trip through the Yakima Valley, where the cherry season, so remarkable in that section of the country, was at its height. The trip was followed by an enjoyable get-together banquet, at which every one was requested to give either a 10-minute or 10-word talk.

The Thursday morning session was called to order at 9:30 a. m. and the following speakers were heard: B. H. Parks of the Addressograph Co., on "Collecting Money by Mail." R. B. Miles, on "Modern Telephone Service," and A. M. Murfin "Connecting Company Commissions." He presented data assembled from two different operating companies which showed an actual cost to the connecting company of 35 per cent for handling the toll business.

During a 10-minute intermission, two boxes of cherries, products of the Sunnyside region, were consumed by the Assembly. The morning session was concluded with a general discussion and a short talk on rate and commission problems by C. V. Angove, assistant engineer of the department of public works.

Secretary and Treasurer Edwin F. Keyes, Vice-president Ruth and President John King.

There Was a Good Attendance of "Live-Wire" Telep hone Men at the Meeting of the Washington Association at Sunnyside.

Much excitement was created by the announcement that a pole-climbing contest would be held on a near-

by corner. Several telephone men are said to have disappeared for a few minutes and then reappeared as photographers. Mrs. Wheelock, lineman and trouble-shooter, of Concrete, is shown "hiking a pole' in the accompanying illustration. She won the contest by a margin of one second.

The afternoon session was taken up by a practical demonstration of the Kellogg service switchboard by R. B. Miles, during which all features under actual service conditions were explained. Two telephones were connected to the board and a No. 6 converter furnished the ringing current.

The Kellogg Company Had a Service Board in Operation.

Following the demonstration, the assembly returned to the meeting hall where talks on the use and abuse of dry cells and on the telecrometer were heard.

The election of officers followed.

The Kellogg Switchboard & Supply Co., had the only exhibit at the convention. It included three-position unit type service switchboard which was utilized in the demonstration by Mr. Miles.

The association plans to have every Independent telephone company a member before the next meeting which is to be held June, 1922, at Pullman, Wash.

Texas Association Has District Meeting at Houston.

Carrying out its usual program of holding several meetings during the summer months, the Texas Independent Telephone Association began this year's activities by holding a mid-summer convention at the Bender Hotel in Houston on July 20.

This is the first telephone meeting the association has held since the annual convention last March. It is the first meeting of this kind the association has ever held in Houston or South Texas. It was rather an experiment on the part of the officers to see if enough interest could be worked up in that part of the state to justify holding a meeting somewhere in that section every year.

The meeting was given considerable publicity and both President Still and Secretary Gardner expressed themselves as well pleased with the attendance at the first meeting. The hotel arranged the convention hall on the ninth floor of the hotel, providing a cool and quiet place for the meeting. Luncheon was served to all those attending the convention by the association.

The meeting was called to order at ten o'clock by President Still, who stated its purpose and briefly outlined the program for the day. The question box, which was to be opened at the close of the meeting, was placed in charge of R. S. Martin, salesman for Kellogg Switchboard & Supply Co., and H. M. Cox, vice-president, The Texas Telephone Co., Waco; all those present who had any question to ask which related to the telephone business were requested to place them in the box.

The first speaker on the program was F. W. Greber, vice-president of the association and general manager of the West Texas Telephone Co., Brownwood, whose subject was "Telephone Engineering and Maintenance." He explained the necessity of building a telephone exchange or toll line properly and the economy resulting from such construction. He discussed the necessity of providing for depreciation and told those present that the telephone man who ignored this important part of the business would sooner or later find his telephone plant in a difficult situation.

A number of the traffic and operating problems that confront the small telephone manager from time to time were discussed by Earl R. Evans, traffic superintendent, Texas Telephone Co., Waco. In his address, "Traffic and Operating Problems," he outlined a set of rules and instructions especially drawn up for the small exchange.

One of the features of the meeting was a talk on "Justifying Fair Telephone Rates," by Garland B. Foscue, Jr., assistant general manager, Texas Telephone Co., Waco, in which he used a stereopticon lantern and slides to explain his points. He told how to determine whether telephone rates at a given exchange are fair or not and how to justify an increase if one is needed.

Judge S. A. Lindsey, president of the Gulf States Telephone Co., Tyler, now residing at Houston, where he is president of the National Bank of Commerce, addressed the convention on "The Financial Situation—As Viewed by a Banker-Telephone Man." Judge Lindsey went into the financial problems of a telephone company and gave his opinion as to what could be expected in the money market for the next six months.

"The Outlook" was the subject of a very interesting address, very ably handled by Judge G. N. Harrison, president, West Texas Telephone Co., Brownwood. Judge Harrison, being a prominent lawyer in West Texas as well as a telephone man, told what he thought would be the problems the Independent telephone people of Texas will have to contend with in the future.

Having been actively engaged in handling legislative matters for the association for several years, R. B. Still, president of the association and general manager of the Gulf States Telephone Co., Tyler, made a very interesting talk on "Utility Legislation." He covered past, present and future legislative matters and problems. He reviewed the work done by the association at the last regular session of the legislature. To the work of the Independent telephone men of Texas belongs a great share of the credit for the state not being burdened with unjust utility laws.

L. S. Gardner, secretary of the association and for a number of years auditor of the Texas Telephone Co., talked on "Telephone Accounting for the Small Company." He explained the need of a set of books for the small company and outlined a system that any small company can install and keep with very little expense.

He stated that he thought a number of small companies had no books because the owners thought it would cost a lot of money and take a lot of time and "red tape" to keep. In his talk he showed how such ideas are groundless.

The opening of the question box brought forth quite a bit of discussion of various telephone problems. This feature of the meeting seemed to draw as much attention as any part of the program. Many valuable points were brought out and a number of telephone problems, presented by those in attendance, were answered.

The meeting adjourned at five o'clock and then some of the delegates went down to Galveston for the evening. There were 39 delegates registered. The meeting was a success in every way and in all probability the Texas association will hold a meeting in that section of the state next year.

There are about 100 companies situated within 100 miles of Houston but the lack of adequate railroad facilities prevented several companies from sending representatives to the meeting.

Telephony to be Taught in St. Louis, Mo. Schools.

A recommendation of Acting Superintendent Maddox that the Southwestern Bell Telephone Co. be allowed to install apparatus at the Patrick Henry Continuation School Center, St. Louis, Mo., to teach telephone operating to girls, was approved recently by the board of education.

Six wall sets and six desk sets have been installed. Pupils at this school are children who are employed but who are required to spend a certain number of hours weekly at school. Telephone instruction is to start in September.

Commissions, Courts and Councils

Discussion and Rulings of State Bodies Having Supervision Over Telephone Companies—Decisions of Courts in Matters of Interest to Public Utilities and Actions of City Councils Relative to Franchise, Rates and Service

Nebraska Subscribers Want to Force $1 a Month Service.

Another Bloomfield situation is threatened in Nebraska, this time at Arcadia, where the telephone exchange is also operated in connection with an electric light plant. The company was recently authorized to continue in effect for the next 60 days the old schedule of rates, which the commission found was not excessive.

A committee of patrons has undertaken to force the company to furnish them service at a dollar a month, instead of the $1.50 authorized by the commission. Circulars have been mailed to all subscribers advising them to offer Manager Wait a dollar a month, and if this sum is refused, to order the instrument taken out and "we, 200 strong, will stand by you."

In the commission's order it was stated that the rates at Arcadia are somewhat below the average rates in the state for a similar class of service and are made possible only by the combination of two businesses under one management and by very careful management by the present owner. The commission will hold a hearing at Arcadia shortly at which protestants have been invited to appear.

The movement at Bloomfield to secure capital enough in that town to buy the local exchange, which is owned by a company with headquarters at Wausa, has apparently failed to get far because of the tight condition of the money market and for the same reason talk of a home-owned company has subsided.

The company has been soliciting a number of former subscribers to resume service. This so alarmed the agitators that they have called a meeting at which it was proposed to discuss the question of hiring an expert accountant to go over the books of the company and find out if the rates are justified and if the state railway commission correctly reported the actual investment.

Consolidation of Companies and New Rates Approved.

Consolidation of three telephone companies in Lagrange, Steuben, Elkhart, Dekalb, and Noble counties is authorized by the Indiana Public Service Commission in an order issued July 14. The order also included a new schedule of rates to become effective August 1.

By the order the Lagrange County Telephone Co. is permitted to buy the properties of the Northern Indiana & Southern Michigan Telephone, Telegraph & Cable Co. and the Pretty Prairie Telephone Co. The Lagrange company assumed $120,940 debts of the two companies, and pays $50,000 for the Northern Indiana company and $4,060 for the Pretty Prairie company. In order to meet these payments the Lagrange company has been authorized to sell $175,000 of its stock at par.

The rates to be applied for the entire system will be $2.25 a month for single business telephones, $1.75 for single line residence, $1.50 for party line residence, and 50 cents for extension telephones.

First Request from Indiana Company to Lower Rates.

Recently the Farmers Telephone Co., of Winchester, Ind., petitioned the Indiana Public Service Commission to decrease its rates from $1.50 to $1.25 net.

The request is said to be one of the biggest shocks the Hoosier commission has received for some time. However, the state body soon recovered and issued an order approving the request.

Asks Increased Rates in Indianapolis Upon Consolidation.

Increased telephone rates for Indianapolis, to be effective October 1, when the consolidation of the manual and automatic telephone systems is completed, are asked in a petition filed recently with the Indiana Public Service Commission by the Indiana Bell Telephone Co.

The proposed increases on three principal classes of service now provided by the manual system average approximately 67 per cent. Increases on three principal classes of service now provided by the automatic system average approximately 160 per cent.

The company also filed a petition for an increase in rates at Anderson.

The schedule filed with the Indianapolis petition provides for the establishment of measure service for both business and residence telephones. This service, according to Frank Wampler, vice-president and general manager of the Indiana Bell Telephone Company, probably will be cheaper to all except the big consumer. The establishment of measured service, he says, will tend to place the burden of costs on the big consumer and in this way make the telephone service cheaper for the small user.

The present rates, the petition states, do not provide adequate revenue for the operation of the company. A statement issued by the company declares the increase in gross revenue from the boost in rates is estimated to be about 40 per cent.

"The income for one year from the operation by the petitioner under such schedule of rates," the petition says, referring to the present rates, "has not been sufficient to pay even the expense of such operation and therefore has provided no revenue whatever for the payment of a fair value of the said properties."

The company asked the commission for an increase in rates last June. After the hearing at that time, in which testimony was given that the company was providing poor service, the company immediately withdrew its petition and the hearing was closed. The collapse of the company's case at that time was due to the testimony of M. D. Atwater, formerly director of service for the commission. Deliberate neglect of the telephone service in Indianapolis and at other exchanges of the company was charged by Mr. Atwater in his testimony.

The public service commission at first thought of using a former valuation of the telephone company's property plus additions and extensions as the basis for action on the petition but later agreed that a new valuation should be made. Six months or more may be required before the commission's engineers can make a valuation of the property. Although this will delay a decision of the commission until long after October 1, there is said to be little likelihood that it will issue a temporary order based on a tentative valuation of the property.

Company Asks Injunction Against Kansas Commission.

Twenty-five cents a month for each subscriber is not a sufficient increase in telephone rates to satisfy the Scott City Telephone Co., of Scott City, Kans., according to its petition filed recently in the Shawnee County District Court asking that the public utilities commission be enjoined from interfering with a higher schedule of rates. The commission granted a 25-cent increase but refused a higher rate.

Minnesota Rate Cases Taken to Supreme Court by Commission.

It is announced that the Minnesota Railroad & Warehouse Commission and Attorney General C. L. Hilton will carry to the United States Supreme Court their fight against increased telephone rates in Minneapolis, recently put into effect by an order of District Judge Wilbur F. Booth and supported by the finding of a bench of three federal judges, who reviewed Judge Booth's order.

The appeal to the supreme court will include the case of the Tri-State Telephone & Telegraph Co., serving St. Paul and southern Minnesota, as well as that of the Northwestern Bell Telephone Co., serving Duluth and northern Minnesota, and also Minneapolis.

Striking Patrons at Lafontaine, Ind., to Form New Company.

Farmer patrons of the LaFontaine Telephone Co., of Lafontaine, Ind., who recently refused to pay the increased rates recently put into effect by the state public service commission and ordered their telephones removed, have started a movement for the organization of a mutual Independent company. A committee has been appointed to investigate the advisability of organizing a new company or securing the service of some other company, and will make its report at a meeting to be held at an early date.

The LaFontaine company furnishes service to patrons of Lafontaine, Somerset, Lincolnville, and Lagro, in addition to the rural districts between the four towns.

Double Taxed for Years—Balked on 300 Per Cent Increase.

The Cadiz Telephone Co., of Henry county, Ind., which recently was the victim of a double assessment, has obtained an amicable adjustment of the matter. The Cadiz company is a mutual organization of farmers and a few people of Cadiz who about 20 years ago contributed to the building of a telephone line. There are 206 shares of stock in the company and for several years they have been selling at from $2 to $5 a share, on which basis the plant would have a valuation of less than $1,000.

However, it was carried on the tax duplicate for $2,500 until this year, when the state tax board took a whirl at it and raised the valuation about 300 per cent, or, to be exact, up to $7,850. Shareholders went up in arms over the increase and after a vigorous protest at a hearing before the tax board succeeded in getting the company's assessment reduced to $2,600.

Burleson Exchange Rates Held Invalid by Ohio Supreme Court.

Telephone rates which the Ohio State Telephone Co. has been charging in Columbus for a year and seven months were set aside recently by the Ohio Supreme Court when it reversed the state public utilities commissions' emergency order entered November 26, 1919, which permitted the company to continue in effect the Burleson exchange rates.

These rates are $69 a year for business telephones and $39 a year for residence telephones, with a $3 discount on each rate for payment within a 10-day period. Whether or not the company will be compelled to refund to subscribers the increased rates paid under protest has not yet been determined.

The supreme court's decision holds that the utilities commission was without authority to abrogate the contract franchise granted by the city on May 8, 1899, which fixed rates as not to exceed $30 a year for residence telephones and $42 for business telephones. The contract provided further that the company could increase its rates $1 a month if it were required to go to the expense of putting wires underground.

Since then the company has put some wires underground, but the city holds that it was not required to do so.

Two other cases in which similar decisions were rendered on the same day are the Newark Telephone Co. and the Bell Telephone Co., of Newark, both companies being ordered to set aside the Burleson exchange rates approved by the utilities commission.

Authorized to Establish Connection and Move Charges.

Service connection, move, and other miscellaneous charges were allowed the Deer Creek Telephone Co., of Deer Creek, Minn. by the state railroad and warehouse commission in an order issued July 18. Here are the connection charges approved:

	Business Stations	Residence Stations	Extension Stations
Instrument not in place	$2.00	$1.50	$1.00
Instrument in place	1.50	1.00	*

*No charge.

Charges for moves, changes in directory listings and other miscellaneous charges are the same as those allowed other Minnesota companies with like connection charges.

The Southwestern's New Rates at Oklahoma City.

In last week's issue of TELEPHONY some mention was made of a recent ruling handed down by the Oklahoma Corporation Commission granting higher rates to the Southwestern Bell Telephone Co. in Oklahoma City, but the rates allowed were not given. Here are the monthly rates approved:

Business:	
One-party line station unlimited service	$7.50
Extension station	1.25
One-party line station measured service	5.00
(Measured service provides 80 outward calls per month; excess calls 3 cents each. In calls unlimited.)	
Residence:	
One-party line station unlimited service	3.25
Two-party line station unlimited service	2.50
Extension station	.75
One party line station measured service—(60 outward calls per month; excess calls 2 cents each. In calls unlimited)	2.25
Joint user service	.50
Extra name service, directory listing	.25
Rural Service—company owned facilities:	
Business station—multi-party	5.00
Residence station—multi-party	2.50
Rural Service Stations:	
Business station	1.50
Residence station	1.00
With a minimum of $6 and a maximum of $20 for any one line, per month.	
Restoration Charge:	
For disconnecting and reconnecting delinquent subscribers	.50

In its application the company submitted exhibits showing that its total revenue during 1920 amounted to $728,186,000, while its expenses totaled $820,364,000, thereby leaving a deficit from operation of $92,178.

The commission took note of the claim made by the company that its operations in 1920 resulted in a large deficit and upchecking over the exhibits and the revenues found the showing made to be substantially correct.

An investigation of the detailed record of expenditures showed that the amount might be decreased by eliminating or reducing certain items. The total expenditures include the amount of $31,599.00 which represents the 4½ per cent paid the American Telephone & Telegraph Co. This amount is represented as being compensation for the rental of instruments and for special financial, engineering, accounting and legal services and use of patents. In regard to the reasonableness of this item, the commission says:

This payment has been a matter of controversy in a very large number of cases before the various courts and commissions, and, while not wholly disapproved by this commission as to the amount of the charge, it is a subject upon which the commission has never been informed to its full satisfaction and which constantly obtrudes upon the mind of the commission as in part a camouflaged dividend.

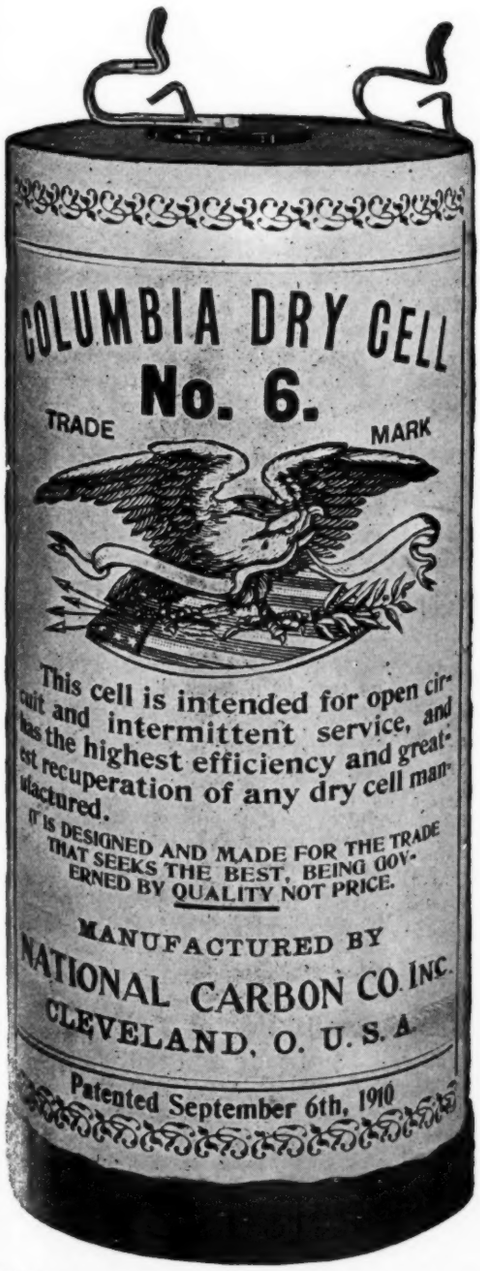
The commission's engineer estimated that the cost of carrying this rented equipment, if it were owned instead of rented, which cost would include the items of repairs, reserve for replacement, return on the investment, etc., as possibly one-half the amount represented by the company, thus reducing the total deficit claimed by approximately $15,000.

A number of other items are also reduced or eliminated by the commission so that the total deficit is lowered $40,000. However, a deficit of $50,000 still remains.

Thus, while the company has made elaborate showings as to the valuation of its property upon which a return is asked to be allowed, the commission stated that

Columbia Telephone Cell

"less cost per day of service"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it could proceed to consider the condition of the company in the light of its revenues and expenses only, and, if it found that there was, in fact, an operating deficit, it would not be justified in deferring all or any relief until it should determine finally the question of valuation and reach a conclusion as to what rate of return would properly be allowable, and then determine what rates should be established to yield such return. Therefore, the rates as set forth in the foregoing are temporary rates only, prescribed to furnish a substantial measure of relief.

In its application the company asked the commission to order all business houses, such as drug stores, cigar stands, billiard halls, etc., paying the regular business rate, where telephones are used by patrons or the public for what is free service to the user, to install coin boxes as a further or incidental source of revenue. This suggestion did not meet with the commission's approval and in refusing to issue such an order, it says:

The business house which permits its telephone to be used in this manner doubtless takes this character of use of its telephone into consideration to some extent in contracting for the same, and its telephone has been installed by the applicant notwithstanding this frequent if not general use of the name in business houses of that character in Oklahoma City.

For the commission to permit the applicant to arbitrarily require a discontinuance of this use of business telephones would be for the commission to read into the contract between the applicant and its patron, a restriction which seemingly is not in its terms. The commission is of the opinion that under average circumstances a business telephone subscriber should be at liberty to permit any use of his telephone that he considers a matter of business advantage to himself.

In granting an increase in rates the commission takes into consideration the substantial improvement in service brought about by the company and the fact that the record of informal complaints made to the commission in regard to telephone service in Oklahoma City during the past 10 months clearly shows that a genuine and successful effort has been made on the part of the company to reduce the number of complaints.

Higher Seasonal Rates for Summer Resorts Allowed.

In an order issued July 14, the Wisconsin Railroad Commission authorized the Winnebago County Telephone Co., of Oshkosh, to increase its seasonal rates for summer resorts from $10 to $15 per subscriber for service from May 1 to November 1. The new rate is to become effective August 1.

The cost of service for seasonal subscribers is made up of the same expense as the cost of service for the rural subscribers of the company, except that the switching expense and the other expenses which depend upon the actual use of the telephone are applicable for only a portion of the year.

After apportioning the expenses of the company on the basis of subscribers and lines, the commission found, assuming that eight subscribers will be on a line, that the expense per subscriber exclusive of switching charge and interest on the investment amounted to $11.58. The switching rate will average $3 per subscriber per season, probably.

Dallas, Texas, Rate Hearing Postponed to September.

The Dallas, Texas, telephone rate hearing before Special Master in Chancery B. K. Goree has been postponed until September by Mr. Goree, according to a recent announcement.

Work on the new telephone rate schedule is progressing, Supervisor of Public Utilities John W. Everman, stated recently, but when it will be completed is not yet known.

Midway (Wis.) Co. Issues Stock—To Purchase New Exchange.

On July 23, the Wisconsin Railroad Commission authorized the Midway Telephone Co. to issue 154 shares of its capital stock of the par value of $100 per share, making a total issue of $15,400, for the purpose of securing funds with which to purchase the plant and equipment of the Medford Telephone Exchange, at Medford now operated by the F. M. Perkins estate. The stock issue is also to secure $2,400, with which to pay for the necessary changes to consolidate the Medford exchange with the other exchanges of the company.

The commission found that the value of the Medford exchange for the purpose of this proceeding was $13,000.

Switching Rates Raised in Adams and Juneau, Wis., Counties.

Switching rates of the Adams County Metallic Telephone Co. were increased on July 1 to $2.60 gross, $1.85 net per quarter on lines where the subscriber owns the lines, poles, and equipment, and $3.25 gross, $2.50 net per quarter on jointly-owned lines, under an order issued June 20 by the Wisconsin Railroad Commission.

The Adams County Metallic Telephone Co. operates exchanges at Storage, Prairie, New Rome, Armenia, Holmeville, White Creek, and Easton, serving 333 subscribers. The vicinity in which the company is situated is not a profitable one, in that it is a sparsely populated rural district, in which the subscribers find it difficult to meet the relatively heavy costs of maintaining the lines.

Subscribers who are switched at the Easton exchange and all switched subscribers at the White Creek exchange own their poles, lines and substation equipment and pay for switching service only. On line No. 12 of the Easton exchange the company built a line 2½ miles to connect with a line built by five subscribers up to within that distance of the exchange. This line is owned jointly by the subscribers and the company.

Rates Are Raised—Toll Charge Ordered Discontinued.

Telephone rates of the Random Lake Telephone Co., operating exchanges at Random Lake, Belgium, and Batavia for 764 subscribers, were increased from $12 per year per subscriber to the following net monthly schedule under an order issued June 22 by the Wisconsin Railroad Commission:

Business, one-party	$1.75
Business, two-party	1.50
Residence, one-party	1.50
Residence, four-party	1.25
Rural, business	1.50
Rural, residence	1.25
Extension telephone	.50
Extension bell	.25
Residence desk sets	.15
Moving charge	1.00

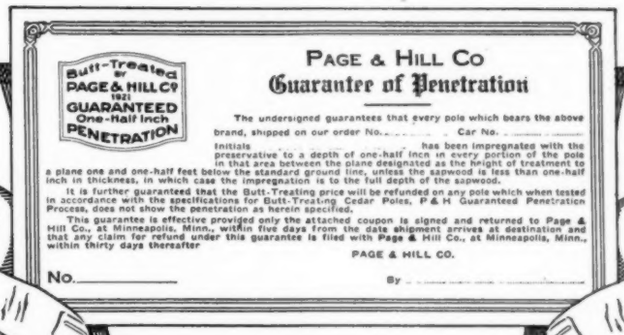
Prior to April 1, 1921, the exchange at Batavia and an exchange at Sand Lake were operated by the East Valley Telephone Co., 446 rural subscribers being served. Both communities being rural communities detached from a railroad, free service was given upon the entire system. On April 1 the Random Lake company purchased the Batavia exchange and cut off the free service between the two exchanges connecting the Batavia exchange with the Random Lake exchange by a toll line.

In its application the company asked permission to continue the present toll charge of 10 cents on this toll line and to give the subscribers the option of paying either 10 cents per call or 25 cents per month for a limit of 15 calls. It was decided at the hearing that in view of the fact that the company expects to connect all lines to the Random Lake exchange and in view of the opposition to the toll charge by subscribers that it should be discontinued for the present.

If it is found that the line is too busy to enable subscribers to have a clear line for business calls, a small toll charge is to be established.

Construction of Telephone Franchise as to Free Service.

A city ordinance providing that the successful bidder shall state in his bid the kind of telephone service he will render, what service he can give by way of telephone connections with surrounding territory and adjacent cities, the maximum rates to be charged for each particular service, and that he shall furnish evidence of his ability to render the character of his service stated in his bid, does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The undersigned guarantees that every pole which bears the above brand, shipped on our order No. Car No.
initials has been impregnated with the preservative to a depth of one-half inch in every portion of the pole in that area between the plane designated as the height of treatment to a plane one and one-half feet below the standard ground line, unless the sapwood is less than one-half inch in thickness, in which case the impregnation is to the full depth of the sapwood.
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This disc countersunk on the butt-end of every pole Butt-Treated by the P & H Guaranteed Penetration Process is your assurance of one-half inch penetration.

not oblige the successful bidder to furnish free service to such neighboring cities, in the absence of a statement to that effect in the bid.

A requirement of automatic reduction of rates to correspond with reductions in such neighboring cities, and forbidding tolls above the rates specified at most forbids tolls on calls to neighboring cities, only if similar calls are free in such cities, and does not forbid a toll equally charged in each city. Citizens Telephone Co. vs. city of Newport, Kentucky Court of Appeals; 224 S. W., 187.

Summary of Commission Rulings and Schedule of Hearings.

CALIFORNIA.

July 19: Application filed by J. Max Landram for approval of sale of a telephone system in the town of Livingston to C. H. Lentz and A. A. Harrington for $9,000.

ILLINOIS.

June 9: Proposed advances in rates by the Canton Home Telephone Co., of Canton, and the Farmington Telephone Co., of Farmington, suspended until December 13.

June 9: Proposed advances in rates by the McNabb Mutual Telephone Co., of McNabb, and the Tilden Telephone Co., of Tilden, suspended until December 18.

June 9: Lease between the Illinois Bell Telephone Co. and the Western Electric Co. covering space at 212 W. Washington St., Chicago, for $75 per month, approved.

June 9: Application of the Calhoun Farmers Co-operative Telephone Co. for a certificate of convenience and necessity to operate an exchange system extending south from Hamburg to Gilead, denied.

June 22: Order issued approving sale by the Johnson County Mutual Telephone Co. to the Murphysboro Telephone Co. of all its telephone property.

June 22: Citation order entered requiring the Alexander County Telephone Co. to appear before the commission at its office on July 6 and show cause why it is furnishing service without proper authority.

June 22: Proposed advance in rates by the Harrisonville Telephone Co. in Columbia, Dupe, Prairie du Rocher, Red Bud, Valmeyer, and Waterloo and toll service between points in Monroe, St. Clair county and Randolph county, suspended until December 25.

June 22: Proposed advance in rates by the Crossville Telephone Co., of Crossville, suspended until December 26.

June 22: Purchase by the Porterville Telephone Co. of property owned by the Annapolis Telephone Exchange in Annapolis, approved; certificate of convenience and necessity granted the Porterville company.

June 23: Proposed advance in rates by the Illinois Telephone Co. in Jacksonville and 12 other cities and villages, suspended until November 14.

June 23: Agreement between the La-Harpe Telephone Co. and the Western Illinois Utilities Co. dated May 26 covering joint use of equipment, approved.

July 6: Lease between the Chicago & Northwestern Ry. Co. and the American Telephone & Telegraph Co. covering land in Ladd Bureau county at $10 to be use for storing poles, approved.

July 6: Order issued authorizing the Litchfield Telephone Co. to place in effect rate schedule IPUC 5 and requiring it to continue in force and effect rates on file with the commission designated as IPUC 3.

July 6: Sale by the Illinois Bell Telephone Co. to H. A. Clegg, of Chandlerville, of one No. 12 iron metallic telephone circuit strung on the Havana-Virginia toll pole between Chandlerville and Saidora for $50, approved.

July 7: Application of William Hofmann, Frank Mittelberg, Fred Kleemeyer and Louis Mittelberg for a certificate of convenience and necessity to operate a telephone line to connect with the switchboard at Burton, denied, it appearing from the record that there is no intention of engaging in business for a profit and therefore no certificate being necessary.

July 7: Proposed advance in rates by the Stark County Telephone Co., in Elmira, Duncan, Castleton, Camp Grove, Toulon and Wyoming, suspended until January 8.

July 7: Proposed advance in rates by the Crescent Telephone Co. in Erie, Hillsdale, and Port Byron, suspended until January 6.

July 20: The Illinois Bell Telephone Co. denied a rehearing on the commission's recent order reducing suburban toll calls through the Chicago exchange from 10 to 5 cents.

July 26: Hearing at Chicago in the matter of application of the Illinois Bell Telephone Co. for an order authorizing the issue of $10,000,000 of its capital stock; motion filed by attorneys to make the city of Chicago a party to the proceeding.

July 27: Hearing at Chicago in the matter of application of the Atwood Electric Light & Power Co. for a certificate of convenience and necessity to construct and operate an electric transmission line in the city of Atwood and furnish electric service; objections filed by the Atwood Mutual Telephone Co.

July 28: Hearing at Chicago in the matter of application of the DeKalb County Telephone Co. for authority to abandon its telephone exchange at Esmond; protest and objections filed by subscribers of the DeKalb County Telephone Co. connected with the Esmond exchange.

KANSAS.

July 15: Hearing on application of the Kansas Telephone Co. for authority to increase local rates in Lawrence and Garnett postponed indefinitely, the commission believing that local subscribers would be unjustly burdened if charged a higher rate to make up a deficiency in the long distance toll revenues of the company.

MICHIGAN.

July 15: Petition filed by the Valley Home Telephone Co. asking the commission to postpone further hearings on the valuation of its properties until auditors of the company and the commission can discover certain missing items of original investment claimed to total $100,000.

MINNESOTA.

July 18: The Deer Creek Telephone Co. authorized to establish service connection, move, and other miscellaneous charges at Deer Creek.

July 22: The Clarkfield Telephone Co., of Clarkfield, authorized to increase rates and establish service connection and other miscellaneous charges.

August 1: The Aitkin-Deerwood Telephone Co. authorized to increase rates in Aitkin, Deerwood, Crosby, Ironton, Cuyuna, Riverton, Trommald, and Manganese.

MISSOURI.

July 12: Application filed by the Kansas City Telephone Co. for an extension of its present rate schedule due to expire by limitation August 1.

July 14: Proposed increase in rates for the Shelbina Telephone Co., of Shelbina, suspended for a further period of 120 days, from August 1 to November 28, 1921.

July 14: Order issued authorizing C. F. Tonn and J. E. Tonn to sell and C. H. Ewart to purchase telephone property in the city of Green Ridge known as the Green Ridge Telephone Co.

July 15: The Jackson County Telephone Co., of Buckner; the Chula Telephone Exchange, of Chula; and the Montgomery Telephone Co., of Montgomery, authorized to continue in effect present schedules of rates for a further period of 13 months, from August 1 to September 1, 1922.

July 20: Rates allowed the Birch Tree Telephone Co., of Birch Tree, in order entered June 25, 1920, authorized as the maximum lawful rates to be charged.

NEBRASKA.

July 20: In the matter of the application of the Farmers Telephone Co., of Dodge county, for permission to charge 25 cents a month for desk sets; this was found to be a fair and reasonable charge, and an order granting permission was issued, no installation charge is to be made therefor.

July 21: Complaint filed by Luther Stevens, of Wilsonville, against the Hendley Telephone Co. alleging inefficient service.

July 21: Complaint filed by F. W. Osborn, of Genoa, against the Monroe Independent Telephone Co., alleging that it made an improper service charge.

NEW YORK.

July 27: Hearing at Albany on citation order entered requiring the Downsville Telephone Co., the Warwick Valley Telephone Co., and the Walton People's Telephone Co. to show cause for failure to file complete and correct 1920 report.

July 27: Hearing at Harrisville on complaint of the Harrisville Chamber of Commerce against the Northwestern Telephone Corp., alleging poor telephone service.

August 1: Hearing at Albany on investigation of the complaint of Mayor Cox, of Middletown against the Orange County Telephone Co. in re rates charged by the company.

NORTH DAKOTA.

July 26: Hearing at Bowman on application of the Silver Bow Telephone Co. for authority to discontinue service.

WISCONSIN.

July 23: The Midway Telephone Co. authorized to issue 154 shares of its capital stock of the par value of $100 per share for the purpose of securing funds with which to purchase the Medford Telephone Exchange, at Medford.

July 23: The Commonwealth Telephone Co., of Madison, authorized to issue $35,000 of its 6 per cent first mortgage bonds; $32,500 of its 7 per cent collaterial trust bonds; and 100 shares of its capital stock of the par value of $100 per share. This stock and bond issue is for the purpose of securing funds with which to purchase the Edgerton Telephone Co., of Edgerton.

July 23: Authority granted E. H. Bauch to increase telephone rates at his exchange at Mellen.

July 23: The Horicon Telephone Co., of Horicon, authorized to increase rates for rural lines to $24 per year for all subscribers.

Central Device

Private Service on PARTY LINE TELEPHONES

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has accomplished this feat

Clearing Device

Operated by

P polarized
R ringer coils connected
I in multiple with the
M main circuit using
A alternating
C current as a source of energy.

The Receiver Down Does Not Interfere With The Line Service

Line Device

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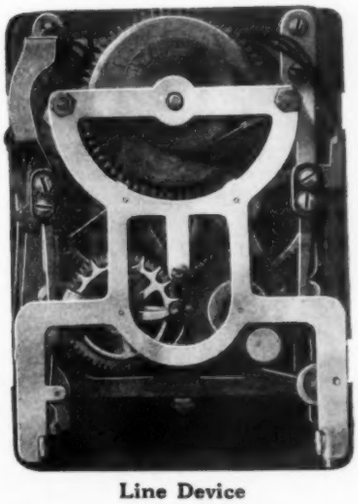
THE PRI—MAC
(TRADE-MARK)
Formerly advertised as "The Select-a-Phone."; Name changed for trade-mark reasons, as previously stated.



Line Device

Biographical and Personal Notes

Clarence Anton Anderson, inventor and builder of the Anderson lockout system (protected by 30 patents) and pioneer in the installation of automatic switchboards, is superintendent of equipment for the United Telephone

Plant Superintendent C. A. Andrews Has Built the United Company's Plant at Abilene, Kans., "From the Ground Up."

Co., with headquarters at Abilene, Kans.

Born at Salina, Kans., August 5, 1881, and educated in the Salina schools and the John G. Whittier school, Denver, Colo., at the age of 18 years. "C. A." started as an apprentice in the factory of the National Telephone Co. at Chicago, working there two years, 1899 and 1900. He then spent one year in the Stromberg-Carlson Telephone Mfg. Co.'s assembling department. From 1901 to 1903 he worked for the National Telephone Co. installing automatic switchboards.

From 1903 to 1906 "C. A." was manager of the Lindsborg and Marquette, Kans., telephone plants, during which time he perfected his "lockout" system. From 1906 to 1908 he worked for the Western Electric Co. at Chicago, doing development and laboratory work. He resigned this position to organize the Anderson Electric & Mfg. Co., with headquarters at Wichita, Kans., for the manufacture of his several telephone devices. He served this company as consulting engineer until 1913 when he went to the United Telephone Co.

As plant superintendent for this company he has built up a manufacturing plant that not merely repairs but constructs telephones and switchboards. He has built this plant "from the ground up" and now employes about 20 men. The gross sales from this plant run about $7,000 per month.

Mr. Anderson is a member of the United States Independent Telephone Association, the Kansas Independent Telephone Association, and has been a consistent participant in the affairs of both of these organizations. "C. A." is a member of the Western Society of Engineers, having been elected an active member in 1910. He is also a member of the Telephone Pioneers of America. His hobbies are telephone development work, music and teaching.

Sherwood Hough, purchasing agent for the Tri-State Telephone & Telegraph Co., St. Paul, Minn., for the past 16 years, resigned June 30, 1921, and is now a traveling salesman for the Jobbers Supply Co., St. Paul.

The resignation of Mr. Hough marks the passing of one of Independent telephony's veterans, a telephone man who has never failed to give his best in the interest of his company. He started the telephone business in the contract department of the Tri-State company April 4, 1901. In 1905 he organized the purchasing department and was made purchasing agent at the same time. It is no exaggeration to say that his acquaintances in the telephone field, through correspondence and personal contact, number in the thousands.

Outdoor life is Mr. Hough's hobby. He is as much at home in a canoe as in a rocking chair on his front porch and he has traveled hundreds of miles over the rivers and lakes of Minnesota in quest of recreation or wild game.

R. V. Achatz, assistant professor in telephone engineering, Purdue University, Lafayette, Ind., left last week for a trip through the West, which will take about a month. He will attend the supreme convention of the Knights of Columbus at San Francisco as a delegate from Indiana. His trip to the coast will include scenery along the Canadian Pacific and probably a visit to the geysers in Yellowstone Park.

George K. Gann, general superintendent, Tri-State Telephone & Telegraph Co., St. Paul, Minn., accompanied by his family, spent two weeks recently at one of Minnesota's ten thousand lakes near Glenwood. Mr. Gann is an enthusiastic and skillful fisherman, so there is no question as to how he spent his vacation.

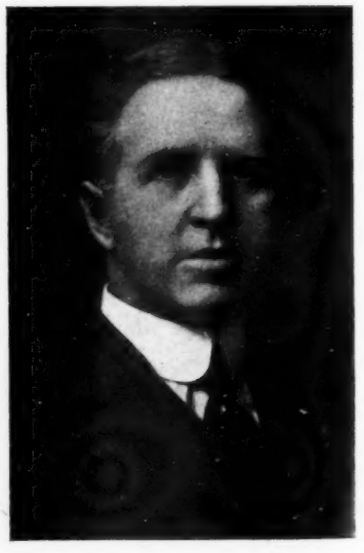
During the early part of the fishing season, there were very few opportunities for fishing that were passed up by Mr. Gann. He has been unanimously elected a member of the inner circle of fisherman in the Tri-State company.

William Green, Jr., chief engineer of the United Telephone Co., Abilene, Kans., is one of the "pioneers" in the telephone business in the West. His first telephone experience was with the old Nebraska Telephone Co. in 1893 and 1894. From this company he went to the J. H. McShane Lumber & Tie Co., and built private lines out of Randolph and Dayton, Wyoming, back into the Big Horn Mountains.

He attended the University of Nebraska at Lincoln, working for the Kansas & Missouri Telephone Co. during vacations and after his graduation in 1898 went back to its employ, holding jobs as installer, cable splicer, construction foreman and engineer, in the order named.

In 1914 Will went to Joplin, Mo., for the Theodore Gary Co., to consolidate the Bell and Home plants. He was next sent to Texas, being associated with the Texas Telephone Co., with headquarters at Waco, and completed the consolidation of the Bell and Home plants in that state. In 1917 he went to the United Telephone Co. as chief engineer and general plant superintendent, having charge of all the physical property of the United company.

Mr. Green is a member of the United



Wm. Green, Jr., of the United Company, Abilene, Kans., Is Another Telephone Pioneer—He's Been in the Field 27 Years.

States Telephone Association, the Kansas Independent Telephone Association, the Nebraska University Alumni Association, Sigma Alpha Epsilon fraternity and the Abilene Country Club. "Chickens" he assigns as his honest-to-goodness hobby.

Attach by hand

Practically indestructible

They are "fool-proof"

Can be used for rehooking old cables?

Can be used over and over again

There are several qualities you want in a cable ring

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Made in eight sizes—1¼", 1½", 2", 2½", 3", 3½", 4" and 4½" for all diameters of strand.

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84 Waters Avenue - - EVERETT, MASS.

Record of Telephone Patents

1,378,774. May 17, 1921; filed June 29, 1920. TELEPHONE ATTACHMENT; one claim; T. J. Farmer, Omaha, Neb. A circular shield, adapted for conforming engagements upon the transmitter, is provided centrally with a hole through which the mouthpiece passes to hold the shield in position. The upper portion of the shield folds over the transmitter top and bears legends as to the office and residence telephone number of the subscriber, while the front portion of the shield carries the number of the telephone and information as to police and fire headquarters telephone numbers.

1,378,836. May 24, 1921; filed January 29, 1919. BALANCING EQUIPMENT FOR FOUR-WIRE CIRCUITS; 11 claims; A. B. Clark and C. S. Demarest, Brooklyn, N. Y.; assigned to American Telephone & Telegraph Co. This transmission circuit includes lines which are interconnected by repeater apparatus. Provision is made to balance the lines and means provided for connecting an operator's listening set with one of the lines. There is a high impedance transformer in this connection to prevent appreciable unbalance of the line.

1,378,919. May 24, 1921; filed March 22, 1919. PORTABLE REPEATING APPARATUS; four claims; J. F. Toomey, New York, and C. G. Spencer, East Orange, N. J.; assigned to American Telephone & Telegraph Co. A repeater set is associated with the terminal arrangements of a cord circuit for interconnecting transmission lines and switching means provided whereby the set may be connected to the terminal arrangements in place of the cord circuit. When so connected, means in the repeater set are responsive to signaling currents for connecting the cord circuit to the terminals in place of the repeater set.

1,378,938. May 24, 1921; filed September 25, 1916. TELEPHONE EXCHANGE SYSTEM; five claims; H. P. Clausen, Mount Vernon, N. Y.; assigned to Western Electric Co. In this trunking system between two central offices, a signaling device in the trunk circuit is located at the second central office. A supervisory relay in the trunk circuit is energized upon connection thereof with a busy line over a circuit including the contacts of the switch hook. Apparatus is controlled by the supervisory relay for causing the intermittent operation of the signaling device.

1,378,940. May 24, 1921; filed March 31, 1919. AMPLIFIER FOR TELEPHONIC TRANSMITTER; one claim; H. T. Dale, New York, N. Y. This amplifier for transmitters comprises a removable slip cover which has a relatively thick annular wall and top, the center of which is pierced to form a single contracted opening. A thin vibrant portion is integrally formed with the annular portion adjacent the opening for forming a sensitive vibrant member for amplifying the acoustic vibration under the top.

1,378,943. May 24, 1921; filed April 24, 1917. SELECTIVE SIGNALING SYSTEM; 10 claims; J. C. Field, Orange, N. J.; assigned to Western Electric Co. The signaling devices of each set are at the different way stations and are controlled in different signaling positions by individual selectors at the set. A polarized electromagnet for each selector is connected in bridge of the line wires and is responsive to constant-sized groups of current impulses of opposite polarity to advance the selectors into the different signaling positions.

1,378,945. May 24, 1921; filed July 12, 1917. STEP-BY-STEP CIRCUIT-CLOSING DEVICE; seven claims; A. F. F. Gilson, Closter, N. J., and O. A. Shann, Brooklyn, N. Y.; assigned to Western Electric Co. Means are operable upon one change in magnetism of a releasing magnet of this step-by-step circuit controlling device to put a holding pawl into operable relation with the releasing magnet. A second change in magnetism acts to withdraw the pawl from engagement with the step-by-step element.

1,378,946. May 24, 1921; filed December 4, 1918. FASTENING DEVICE; four claims; A. F. F. Gilson, Closter, N. J; assigned to Western Electric Co. A strap member having a number of resilient corrugation thereon has a spring member adapted to co-operate with it. This spring member has a tongue portion perpendicular to the strap and fitting between adjacent corrugations to hold the members in lot engagement.

1,378,947. May 24, 1921; filed July 14, 1917. MACHINE SWITCHING TELEPHONE SYSTEM; 16 claims; C. L. Goodrum, New York; assigned to Western Electric Co. In this machine switching system step-by-step mechanism operates to drive movable shafts of the contact banks in one direction and then in a second direction. Brushes carried by the shafts are arranged to co-operate with the contact banks.

1,378,950. May 24, 1921; filed December 4, 1918. RECORDING KEY; two claims; A. D. Hargan, Bayonne, N. J.; assigned to Western Electric Co. The construction of a key set is described in this patent. Means carried by each of the keys of the set are engaged by a pivoted latch plate upon depression of its respective key to lock such key in depressed position. A lug mounted on each of the keys and permanently positioned within one of the apertures of the pivoted latch plates serves to limit the downward and upward movement of its respective key.

1,378,969. May 24, 1921; filed March 22, 1920. METHOD OF MANUFACTURING INDUCTANCE COIL; three claims; I. L. Milton, East Orange, N. J.; assigned to Western Electric Co. The process of manufacturing a magnet core is described. It consists in baking the core, demagnetizing it and subsequently subjecting it to a second baking.

1,378,982. May 24, 1921; filed September 17, 1918. SIGNALING SYSTEM; 22 claims; H. E. Shreeve, Millburn, N. J.; assigned to Western Electric Co. In this radio system, independent means are provided for transmitting radio signal waves modified in accordance with signals. An asymmetric transmitting channel is connected to the independent means and terminates at the central station. A two-way signal line terminates at the central station and provision is made for connecting it to the transmitting and receiving channel at will.

1,378,990. May 24, 1921; filed June 13, 1918. SIGNALING DEVICE; three claims; J. A. Wotton, Montclair, N. J.; assigned to Western Electric Co. In this visual signal device a face member is provided with a circular aperture. A conoidal target member is normally adapted to partially protrude through the aperture of the face member and is withdrawn by electromagnetic means.

1,379,017. May 24, 1921; filed February 21, 1916. SEMI-AUTOMATIC TELEPHONE SYSTEM; 38 claims; G. A. Yanochowski and H. E. Hershey, Chicago; assigned to Automatic Electric Co. Manual equipment is provided for controlling one of a number of automatic switches having access to called lines to find the called line. Provision is made for releasing the switch when the called line is busy and a relay in the equipment is operated, when the switch is released, to operate signals in the calling line and the manual equipment.

1,379,068. May 24, 1921; filed February 12, 1919. MEASURED SERVICE TELEPHONE SYSTEM; 10 claims; J. Wicks, Chicago; assigned to Automatic Electric Co. Means are provided for operating a meter-controlling relay to close one point of the meter circuit. Auxiliary controlling means delay the operation of the meter by holding the circuit open at another point in the circuit.

1,379,287. May 24, 1921; filed June 21, 1918. TELEPHONE INSTRUMENT; 21 claims; F. J. Reichmann and J. Press, Chicago. In this instrument an armature is movably supported upon one pole of a magnet and extends into operative relation with the other pole. Provision is made for changing the form of the magnet to alter the relative position of the pole.

1,379,557. May 24, 1921; filed August 13, 1919. RECEIVER HOOK SWITCH FOR PORTABLE TELEPHONE; five claims; J. T. Gray, Great Falls, Mont. In this desk stand, a rod within the upright extends through the supporting plate and its lower portion engages an arm pivoted to the base, intermediate between a point of support and the contact member carried by it. A receiver hook is pivoted to the upright and pivotally supports the rod. When the hook is raised, a resilient member acts to close the switch.

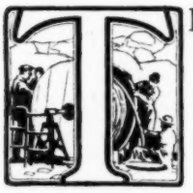
1,380,039. May 31, 1921; filed October 28, 1916. AUTOMATIC TELEPHONE SYSTEM; 28 claims; W. A. Chapin, Chicago; assigned to Automatic Electric Co. This automatic selector switch has a directively-controlled primary movement for selecting groups of lines and an automatic secondary movement to select an idle line in a group. Provision is made for continuing the secondary movement, whether all the lines in the group selected in the primary movement are busy or not.

1,380,374. June 7, 1921; filed November 21, 1919. SIGNALING SYSTEM; five claims; F. B. Gardner, New York, assigned to Western Electric Co. Means are associated with the line circuit, and responsive to signaling current received thereover for simultaneously localizing a selection of the line circuit and associating a source of current and a signal-controlled means with the localized section.

1,380,451. June 7, 1921; filed May 13, 1918. TELEPHONE EXCHANGE SYSTEM;

Electrolysis?

Use fibre conduit



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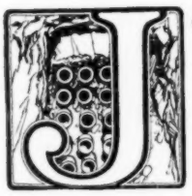

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seven claims; R. S. Wilbur, Lyndhurst, N. J.; assigned to Western Electric Co. In this manual trunking system, a relay at one end of the trunk circuit is adapted to successively open its contacts upon its relief, and this successive opening of the relay contacts acts to cause the continuous operation of a signal at the other end of the trunk circuit.

1,380,751. June 7, 1921; filed July 9, 1919. REPEATER NETWORK SELECTING APPARATUS; six claims; J. F. Toomey, New York, and C. S. Demarest, Brooklyn, N. Y.; assigned to American Telephone & Telegraph Co. This balancing arrangement comprises an artificial transmission line and an auxiliary balancing set for simulating the auxiliary apparatus associated with a transmission line. Switching means, controllable at will, are adapted to disconnect the artificial line from the balancing arrangement, but other means act to prevent the disconnection whenever the auxiliary apparatus is replaced by simular apparatus.

1,380,752. June 7, 1921; filed July 9, 1919. ELECTRICAL RELAY; three claims; J. F. Toomey, New York; assigned to American Telephone & Telegraph Co. In this electro-magnet, contact points and metallic filings are included in a receptacle associated with the pole of the electromagnet. A circuit is completed over the contact points and means controlled by the repellent action on the metallic filings produced by an alternating electromagnetic force in the magnet, act to control the circuit.

1,380,857. June 7, 1921; filed December 31, 1919. TELEPHONE EXCHANGE SYSTEM; 10 claims; S. B. Williams, Jr., Brooklyn, N. Y.; assigned to Western Electric Co. In this automatic system a number of line finder switches are arranged for co-operation with each of the sections in the contact banks. The various groups are so arranged in the sections that a different group appears as the first choice in each of the sections. Means are operative upon the initiation of a call for putting into operation an idle one of the switches which serve a section of the contact bank in which the group containing the contact set of the calling line appears as a first choice.

1,380,981. June 7, 1921; filed April 21, 1917. TELEPHONE; six claims; I. Langmuir, Schenectady; assigned to General Electric Co. This telephone comprises a number of diaphragms, each having such area as to vibrate substantially as a unit. The diaphragms are combined to constitute a surface having a diameter of the order of magnitude of at least about two feet. The diaphragms are vibrated in unison in response to a telephonic current.

1,381,081. June 7, 1921; filed November 16, 1920. DEVICE FOR USE IN DISINFECTING TELEPHONE INSTRUMENTS; three claims; R. Cooper, London, England. An annular absorbent pad is located in an annular casing formed of separable members. The pad comprises concentric perforated tubes having absorbent material in the annular space between them. The device is secured to the transmitter mouthpiece between the mouthpiece and the transmitter.

1,381,192. June 14, 1921; filed October 2, 1920. CONDUIT OR CABLE CLAMP AND BRIDLE RING; one claim; W. H. Hiss, New York; assigned to Diamond Expansion Bolt Co., New York. This open bridle ring has one of its ends unsupported. The other end is bifurcated and provided with means to co-operate with a conduit or cable clamp.

1,381,195. June 14, 1921; filed May 15, 1919. TELEPHONE SYSTEM; 26 claims; H. H. Ide, LaGrange, Ill.; assigned to Kellogg Switchboard & Supply Co. In this automatic system an automatic-adding type connector switch is individual to the subscriber's line and is controlled over the two sides of the line in series. Other subscribers' lines terminate in a single row or level of bank contacts in the switch while subscriber-controlled means for the switch connect the first subscriber's line to any one of the other subscribers' lines. Subscriber-controlled means ring the called substation and automatic means move the switch back to normal position.

1,381,343. June 14, 1921; filed July 14, 1919. TELEPHONE ATTACHMENT; two claims; L. P. Sampson, Worcester, Mass. This telephone attachment for desks stands has in combination a tubular coin receptacle which is clamped to the upright of the desk set.

1,381,368. June 14, 1921; filed April 1, 1919. BUSY-BACK CIRCUITS; eight claims; J. F. Toomey, New York; assigned to American Telephone & Telegraph Co. This busy back circuit includes a number of packs, conductors being associated with their ring contacts. Means responsive to the association of a trunk circuit with one of the jacks applies ground to all of the ring conductors, which is disconnected by means individual to the ring conductor.

1,381,431. June 14, 1921; filed August 27, 1918. MACHINE-SWITCHING TELEPHONE SYSTEM; 12 claims; L. Polinkowsky, London, England; assigned to Western Electric Co. Means at a first operator's position extend a second calling line to a second operator's position, while a series of automatic switches are operated to extend the second calling line to the called line. Provision is made for notifying the operator at the second position of the busy condition of the called line.

1,381,451. June 14, 1921; filed June 24, 1919. SWITCHING SYSTEM; five claims; L. E. Coon, Chatham, N. J.; assigned to Western Electric Co. In this switching system are included a phantom circuit, a selecting station, and a number of selectively operable switching devices associated therewith. Current impulses are transmitted over the phantom circuit to advance any of the switching devices into predetermined position. Each switching device controls means to prepare a circuit, including the physical conductors comprising a side circuit of the phantom circuit, when the associated device reaches its predetermined position. The relation of such conductors in the prepared circuit differs for each device. Signaling means are controlled by each prepared circuit while means at the selecting station associate a second source of current with the prepared circuit to operate the signaling means controlled thereby.

1,381,456. June 14, 1921; filed April 11, 1919. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; 12 claims; G. Deakin, London, England; assigned to Western Electric Co. The feature of this patent is the provision for placing a different electrical condition on the trunk lines by means of which the operation of the automatic selecting switch is controlled. Provision is made for automatically changing the electrical condition on the trunks to correspond to the electrical condition on the subscriber's line so as to render the trunks of the same identity as the subscribers' lines.

1,381,460. June 14, 1921; filed December 31, 1919. MAGNET CORE; three claims; J. W. Harris, Montclair, N. J.; assigned to Western Electric Co. This method of making magnet cores consists in reducing electrolytic magnetic material to the form of particles and annealing and then flattening the particles, coating them with insulating material and then submitting the mass to pressure sufficient to compress it into a self-sustained solid.

1,381,470. June 14, 1921; filed October 26, 1920. TELEPHONE MUFFLER; one claim; M. E. Kelleher, Rutland, Vt. This telephone muffler comprises a hollow cone-shaped body formed of springy material and in a single piece. The smaller end is adapted to fit into a transmitter mouthpiece and the larger end shaped to fit the face and around the mouth of the user.

1,381,480. June 14, 1921; filed February 17, 1917. TELEPHONE SYSTEM; seven claims; A. E. Lundell, Chicago; assigned to Western Electric Co. The feature of this automatic system is a group of relays associated with the extension circuit for the lines. Provision is made for causing the successive impulses impressed upon an extended line to selectively effect the operation of any one of the relays independently of the action of any other relay of the group. Signals are associated with the relays and arranged to be displayed under their control.

1,381,483. June 14, 1921; filed September 25, 1917. TELEPHONE EXCHANGE SYSTEM; 12 claims; H. W. McDougall, East Orange, N. J.; assigned to Western Electric Co. A relay in the link circuit is energized upon connections thereof with a telephone line. A ringing relay when energized connects a source of ringing current to the telephone line. An energizing current for a talking circuit relay includes a normally-closed contact of the ringing relay which is completed upon the energization of the first relay when the telephone line is closed, whereby the talking circuit relay is energized for disabling the initial energizing circuit of the ringing relay.

1,381,530. June 14, 1921; filed May 16, 1919. TELEPHONE EXCHANGE SYSTEM; 19 claims; S. B. Williams Jr., Brooklyn, N. Y.; assigned to Western Electric Co. In this system, groups of finder circuits are provided for extending the telephone lines to an operator's position. Distinctive controlling means are associated with each group of finder circuits while indicating mechanism at the operator's posion is selectively responsive to the distinctive controlling means of the various group of finder circuits.

1,381,545. June 14, 1921; filed September 16, 1919. REPEATER CONTROLLING SYSTEM FOR FOUR-WIRE TELEPHONE CIRCUITS; five claims; C. S. Demarest, Brooklyn, N. Y.; assigned to American Telephone & Telegraph Co. In this signaling system, the four-wire transmission circuit is comprised of two two-wire side circuits electrically related by means of transformers. Switching means is provided to effect the connection of a repeater element with each side circuit. The means which control the switching mechanism comprise a relay controlled by the flow of current over a circuit simplexed upon the two-wire terminals of the four-wire circuit and the associated cord circuit whereby the switching means may be prevented from connecting the repeater elements with the side circuits of the four-wire circuits.